

**TMUA PROJECT No. WPC 23-4,
FY '23 SOUTHSLOPE CAPITAL EQUIPMENT
REPLACEMENTS**

ATTENDANCE AT PRE-BID CONFERENCE IS MANDATORY

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TECHNICAL SPECIFICATIONS

**Technical Specifications for
TMUA Project No. WPC 23-4,
FY '23 Southslope Capital Equipment Replacements**

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1 Summary of Bid Items

	Item Description
Bid Item 1	<u>Cleaning of Digester 1</u> at the Southside Wastewater Treatment Plant. This includes: removal of residual material; wash down of internal surfaces; flushing of pipes; and cleaning of sludge mixers.
Bid Item 2	Proper disposal of <u>Residual Material</u> in Digester 1. This bid item is a unit price per cubic yard. For bidding purposes, the estimated volume of Residual Material is 3,100 cubic yards.
Bid Item 3	Proper disposal of <u>Trash</u> in Digester 1. This bid item is a unit price per cubic yard. For bidding purposes, the estimated volume of Trash is 110 cubic yards.
Bid Item 4	Remove, clean, and service the four (4) <u>Sludge Mixers</u> of Digester 1. This includes replacing the upper and lower bearings. This work is to be coordinated with the cleaning of Digester 1.
Bid Item 5	Prepare Digester 1 for <u>Inspection</u> by providing ventilation, scaffolding, power washing, and lighting inside the digester.
Bid Item 6	Replacement of seven (7) <u>Sludge Valves</u> in the Digester 1&2 Building at the Southside Wastewater Treatment Plant. This work can only be done while Digester 1 is empty.
Bid Item 7	Installation of one (1) <u>Foam Detecting Radar</u> on Digester 1 at the Southside Wastewater Treatment Plant. This includes electrical work and SCADA programing. This work can only be done while Digester 1 is empty.
Bid Item 8	Installation of two (2) <u>Sludge Sampling Stations</u> in the Digester 1&2 Building at the Southside Wastewater Treatment Plant.
Bid Item 9	Rehabilitation of the <u>Diffused Air System</u> within Aeration Basin 1 at the Southside Wastewater Treatment Plant. This includes replacing the membrane disc diffusers, repairing or replacing any broken components, and commissioning of the complete system.
Bid Item 10	Replacement of eight (8) <u>Digester Gas Valves</u> at the Digester Buildings of the Southside Wastewater Treatment Plant. This includes a flanged spool pipe for each valve.
Bid Item 11	Extra Work Allowance
Bid Item 12	Mobilization Allowance. The Mobilizations Allowance shall not exceed 5% of the sum of Bid Items 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11.
Bid Item 13 Add Alternate A	Replacement of the <u>Guard Shack</u> located at the entrance of the Southside Wastewater Treatment Plant.

2 Contact Information

The Engineer and main point of contact for this project is:

Peter R. Denis, P.E.
City of Tulsa Water and Sewer Department
Southside Wastewater Treatment Plant
5300 S. Elwood Ave., Tulsa, OK 74107
T: 918-591-4482, C: 918-381-2404
E: pdenis@cityoftulsa.org

Alternate points of contact for this project are:

Superintendent, Southside Wastewater Treatment Plant	Josh Fisher 5300 S. Elwood Avenue Tulsa, OK 74107 918-591-4450 jfisher@cityoftulsa.org
Water Pollution Control Manager	Matt Vaughan, P.E. 175 E. 2nd Street, Suite 1400 Tulsa, OK 74103 918-591-4456 mvaughan@cityoftulsa.org

3 Common Requirements for All Bid Items

3.1 Contractor's Responsibility

Contractor will refer to the following sections of the Contract Documents regarding the Contractor's risk and responsibility:

- Paragraph B-9 of the Instructions to Bidders.
- Article I of the Contract.
- Paragraph GC-7 and GC-18 of the *General Conditions of Contract*.

- 3.1.1 In general, the intent is for this project to be a turn-key replacement of existing equipment with minimal changes needed for installation or operation. Contractor will remove and dispose the existing equipment for each bid item and install new, like-kind equipment.

The proposed equipment will have the same capacity; have the same performance; be of the same materials; and utilize the same type of electrical power supply (voltage, phase, frequency) as the existing equipment. Any variation from this will be addressed in the specific requirements for each bid item.

Contractor will verify the Complete System is fully operational. The Complete System consists of the new equipment combined with any previously-installed facility equipment and structures.

3 Common Requirements for All Bid Items

3.1.2 Contractor will coordinate, provide, and bear the cost of all items below:

- Equipment, materials, tools.
- Labor, supervision, coordination.
- Delivery, unloading, storage.
- Rigging, lifting, material handling.
- Portable lighting and illumination.
- Forced air ventilation.
- Atmospheric testing.
- Flow stoppage, plugging, bypass pumping, sump pumping.
- Vacuum truck service and disposal of grit, sludge, sediment.
- Pumping or vacuum service needed if facility equipment (valves, pumps, etc.) are not functional or sufficient to drain or maintain drained conditions.
- Trash service and disposal of debris.
- Methods to prevent debris from going into drains.
- Protection of equipment and materials from damage.
- Protection of water coils and water piping from freeze damage.
- Procedures to prevent damage to underground pipes or utilities.
- Paint or coatings to protect new equipment and materials from corrosion.
- Electrical wires, cable, conduit, terminations, and other incidental items.
- Fasteners, hardware, equipment bases, and other incidental items.
- Modifications or replacement of concrete bases to accommodate the new equipment.
- Modifications to any previously-installed facility equipment and structures.
- Modifications or adaption needed to allow new equipment to properly fit with any previously-installed facility equipment and structures.
- Modifications due to new code requirements.
- Modifications due to new industry standards.
- Modifications due to lack of availability of certain equipment or materials.
- Fees, permits, inspections.
- Complying with all applicable regulations of the Oklahoma Department of Environmental Quality (ODEQ), including all paperwork requirements.
- Complying with all applicable regulations of the Occupational Safety and Health Administration (OSHA).

3 Common Requirements for All Bid Items

3.2 Coordination with Plant Operations

- Contractor will plan his Work to minimize interruption of plant operations. It may be necessary for the Contractor to conduct Work at night, during low flow periods, and for short periods of time.
- Significant Events are defined as:
 - Removing equipment from service.
 - Flow stoppage.
 - Bypass pumping.
 - Placing equipment back into service.
 - Start-up or inspection of equipment.
 - Equipment training.
 - Any other activity that requires coordination with plant operations.
- Contractor will coordinate with the Engineer or Superintendent at least two (2) days before conducting any Significant Events (as defined above).

3.3 Project Schedule

Contractor will refer to Paragraph GC-13 of the *General Conditions of Contract* regarding the Project Schedule (also known as the progress schedule). Contractor will coordinate with the Engineer for approval of the Project Schedule format and delivery method. Contractor will meet with the Engineer on a regular basis to review the Project Schedule.

- 3.3.1 Contractor will provide a *preliminary* Project Schedule to the Engineer within two (2) weeks of issuance of Order to Proceed. The *preliminary* Project Schedule will show all the Bid Items and any additional information that the Contractor chooses.
- 3.3.2 Contractor will provide an *updated* Project Schedule to the Engineer on a regular basis, as necessary, to reflect changes to the schedule. The *updated* Project Schedule will change throughout the course of the project, but will ultimately show the following information for each Bid Item:
 - Date when the Contractor plans to start Work.
 - Date when the Contractor plans to complete Work.
 - Dates of any Significant Events as defined in Section 3.2.
 - Warranty-start date.

3 Common Requirements for All Bid Items

3.4 Submittal Requirements

Contractor will refer to Paragraphs GC-2 and GC-5 of the *General Conditions of Contract* regarding documents that are submitted for review. Contractor will submit documents to the Engineer and will coordinate with the Engineer regarding the media format and delivery method.

3.4.1 Documents for Review

3.4.1.1 Contractor will provide one (1) copy of Documents for Review for each Bid Item. Either soft copy or hard copy format is acceptable. Contractor will submit Documents for Review early enough to allow for review, possible corrections or changes, resubmittal, and additional review. The Contractor will plan for a two (2) week review by the Engineer for each submittal and resubmittal.

3.4.1.2 Documents for Review consist of the following for each Bid Item:

- Equipment and Material Datasheets with information such as:
 - Make and model.
 - Size and dimensions.
 - Performance information.
 - Materials of construction.
- Preliminary Operation and Maintenance Manuals.
- Additional information, as appropriate, such as:
 - Installation and Start-up instructions.
 - Outline drawings showing dimensions, components, and materials.
 - Drawings or sketches showing the proposed route of new piping.
 - Plans for any modifications to current facility equipment and structures.

3.4.1.3 Documents for Review are required before starting Work on each Bid Item. See Section 3.7.1.

3 Common Requirements for All Bid Items

3.4 Submittal Requirements (continued)

3.4.2 Documents for Record

- 3.4.2.1 Contractor will provide one (1) Soft Copy Operations and Maintenance Manual (Soft O&M) for each Bid Item. The Contractor will create the Soft O&M by using appropriate computer software to combine the documents into a single PDF file. The Contractor will use appropriate computer software so that the text of the Soft O&M is selectable and searchable. The Contractor will mark through or remove non-applicable information in the Soft O&M which is not relevant to the equipment that has been supplied. The Soft O&M will contain the following documents in the order that they are listed:
- NAMEPLATE AND SUMMARY DATA: Contractor will coordinate with the Engineer to obtain a current soft copy of the NAMEPLATE AND SUMMARY DATA form. The Contractor will enter the information into this form using appropriate computer software so that the text is selectable and searchable when it is part of the Soft O&M.
 - Manufacturer's Operation and Maintenance Information.
 - Additional information, as appropriate, such as: start-up report; installation; calibration; adjustment; troubleshooting; parts list; recommended spare parts; electrical wiring diagrams; as-built construction drawings (also known as red-line drawings).
- 3.4.2.2 Contractor will provide one (1) Hard Copy Operations and Maintenance Manuals (Hard O&M) for each Bid Item. Each Hard O&M will contain the same information as the Soft O&M. Each Hard O&M will be printed on paper and bound together.
- 3.4.2.3 Documents for Record are required for each Bid Item and form a part of the Work for each Bid Item. See Section 3.12 regarding Payment.

EQUIPMENT NAMEPLATE AND SUMMARY DATA

Equipment ID: _____

Description: _____

Project #: _____

Spec. #: _____

Vendor: _____

Manufacturer: _____

Model #: _____

Serial #: _____

Purchase Price: \$ _____

Date Placed in Service: _____

Parts Associated/Details: _____

Maintenance Schedule (Summarized from O&M Manual)

✓ Initial: _____

✓ Weekly: _____

✓ Monthly: _____

✓ Semi-Annual: _____

✓ Annual: _____

Applicable Motor Information: N.A. (Circle if not applicable)

Vendor: _____

Manufacturer: _____

Model #: _____

Serial #: _____

Frame: _____ Insul. Class: _____

Volts/Hz/Amps: _____

HP / RPM / SF: _____

3 Common Requirements for All Bid Items

3.5 Contractor Access Cards

3.5.1 A Contractor Access Card, issued by the City of Tulsa Security Office, is required for the following people:

- The driver of each vehicle that will be entering the facility multiple times or on a regular basis.
- Sub-contractors and foremen that will be supervising other workers.
- Any other individual as directed by City of Tulsa Security, Plant Superintendent, or WPC Manager.

The Contractor Access Card allows vehicular entry through the front gate of the Southside Wastewater Treatment Plant, Cherry Creek Facility, and 71st Street Dewatering Facility.

3.5.2 Contractor will coordinate with the Engineer to request Contractor Access Cards. Application for a Contractor Access Card will require a background investigation. Each person that is applying for a Contractor Access Card will need to complete the following two (2) forms:

- City of Tulsa Access Card / Identification Card Request Form
- City of Tulsa Background and Prescreen Investigation Form

A current soft copy of the forms can be obtained from the Engineer.

3.5.3 The Contractor will send the completed forms to the Engineer. The Engineer will submit the completed forms to the City of Tulsa Security Office. Approved individuals will coordinate with the City of Tulsa Security Office to complete the process and obtain their Contractor Access Card.

3.5.4 Six (6) months is the maximum time that a Contractor Access Card is active. The Contractor may coordinate with the Engineer to request re-activation of Contractor Access Cards. Re-activation may require re-application and additional background investigation.

Access Card/Identification Card/Driver's License & Key Request Form

☐ **NEW ISSUE** ☐ **REPLACEMENT** (\$15 per key for lost or non-returned keys/keycards)

As per terms of this Agreement, I agree that I will NOT DUPLICATE or LOAN this key/keycard and I will **RETURN it directly to the City of Tulsa Security office** when my need for it terminates. I agree to pay the appropriate replacement charge if this key is lost.

Keys will not be issued for incomplete forms and only one key issued per form.

New Employees must attend Session I and Session II of New Employee Orientation before being issued an official City of Tulsa Access/Identification Card or Driver's License.

		<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D		
Employee Oklahoma Driver's License Number: _____		Driver's License Class: _____		Expiration Date: _____
Last Name: _____	First Name: _____	Middle Initial: _____	Suffix: _____	
Date of Birth: (MM/DD/YY) _____	Hair Color: _____	Eye Color: _____	Weight: _____	Height: _____
			<input type="checkbox"/> Regular <input type="checkbox"/> Temporary <input type="checkbox"/> Intern	
Department: _____	Job Title: _____	Employment Status: _____		

I have received and read the computer use and the above key duplication policy:

Signature: _____

TYPE OF KEY/ACCESS REQUESTED: <input type="checkbox"/> METAL KEY <input type="checkbox"/> ACCESS CARD				
Building info is needed for access card. Room, Hinge, Suite, Floor and Key number information is for metal keys only.				
Building(s) Requested: _____				
		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Room Number: _____	Hinge Number: _____	Suite Master: _____	Floor Master: _____	Key Number: _____
SUPERVISOR USE ONLY – Departmental Authorization. Department Head Must Request/Approve Access Cards.				
This employee <input type="checkbox"/> does or <input type="checkbox"/> does not require a COT DL .			Supervisor Name: _____	
<input type="checkbox"/> New Employee <input type="checkbox"/> Replacement <input type="checkbox"/> Current Employee			Supervisor Title: _____	
Employment Status: _____			Supervisor Signature: _____	
Department Head Approval: _____			Date: _____	
SECURITY USE ONLY			FACILITIES MAINTENANCE KEY SHOP INFORMATION	
Security Notified by Safety Loss Control to issue City License:			Key Number: _____	
<input type="checkbox"/> Yes <input type="checkbox"/> No Date Issued: _____			Date Issued: _____ Date Returned: _____	
Issued By: _____			Issued By: _____	

Issued By: _____

Date: _____

Driver's record will be reviewed by H.R. Safety Section. City of Tulsa driver's license can be revoked at anytime. Fill out and bring to City Hall, Street Level Security office with your State Identification or Driver's License

COMPLETED FORMS MUST BE SUBMITTED TO PUBLIC FACILITIES SECURITY // Email: access@cityoftulsa.org or Fax (918) 699-3437

Background and Prescreen Investigation Form

City of Tulsa Security

Last Name:		First Name:		Middle Initial:	Maiden Name:
Aliases:			Date of Birth: (MM/DD/YY)		Social Security Number:
<input type="checkbox"/> Female <input type="checkbox"/> Male					
Gender:	Height:	Weight:	Race:	Driver's License Number & State:	Home Phone Number:
Applicant Address:			City:	State:	Zip:
Employer Name:				Business Phone Number:	
Employer Address:			City:	State:	Zip:

Have you ever been convicted of, pled guilty, or "no contest" to a crime that has or has not been expunged or removed from your record?

☐ Yes ☐ No *If yes, please explain below.*

1. I understand that an investigative report may be generated on me that may include information as to my character and work habits, along with criminal history records from any criminal justice agency in any or all federal, state, city and county jurisdictions, State Department of Motor Vehicles, Military, and Social Security Administration. I fully understand that the City of Tulsa may be requesting information from public and private sources about any of the information noted earlier in this paragraph, and I freely give my consent for the City of Tulsa to do so. I also attest under the penalty of perjury that the information above is complete and true to the best of my knowledge. Lastly, I understand that presence of a conviction does not automatically preclude me from eligibility. Consideration will be given to the nature of the offense, time since conviction and all other relevant facts and circumstances pertaining to the situation. Likewise the absence of such convictions will not mean automatic acceptance of eligibility.

Applicant Signature: _____ Date: _____

OFFICE USE ONLY

Facility:

Contractor:

Sources: ☐ OSCN ☐ Juris ☐ TPD ☐ Doc ☐ Other

Disposition: ☐ Affirmative ☐ Negative ☐ Inconclusive

Investigator: _____ Date: _____

3 Common Requirements for All Bid Items

3.6 Equipment and Material Removal

Contractor will provide all of the following for any equipment or material removal:

- Proper termination of any piping.
- Proper termination of electrical wire and conduit.
- Proper plugging or filling of any holes.

3.7 Installation

3.7.1 Before starting Work for each Bid Item, Contractor will do all of the following:

- Submit Documents for Review to the Engineer as per the Submittal Requirements.
- Verify the Documents for Review have been checked and accepted by the Engineer as per Paragraph GC-5 of the *General Conditions of Contract*.
- Field-verify all necessary dimensions.
- Field-verify the available electrical power supply (voltage, phase, frequency).
- Field-verify the conditions of facility equipment and structures.
- Verify that the capacity, performance, and dimensions of the new equipment will allow for proper operation of the Complete System.
- Verify that clearances between any new equipment and any previously-installed facility equipment and structures are reasonable, safe, and allow for proper operation of the Complete System.
- Coordinate with the Engineer for approval of any modifications to facility equipment and structures.
- Verify the availability of the equipment and materials the Contractor plans to use.
- Coordinate with Plant Operations in accordance with Section 3.2.

3.7.2 During and after installation of new equipment, Contractor will do all of the following:

- Install new equipment per the manufacturer's instructions.
- Verify the new equipment is installed correctly.
- Test the newly installed equipment under actual operating conditions.

3 Common Requirements for All Bid Items

3.8 Corrosion Protection

3.8.1 Corrosive Areas are defined as:

- Areas where sewage is conveyed, stored, or treated.
- Areas that are exposed to the liquid, solid, or gaseous by-products of sewage treatment.
- Areas that are subject to spills, overflows, flooding, and subsequent wash-down.
- Areas where chemicals are used or stored.

Corrosive Areas are characterized by the following contributors to corrosion:

- The continuous presence of moisture and condensing humidity on a diurnal cycle.
- The continuous presence of trace amounts hydrogen sulfide (H_2S).
- The natural formation of sulfuric acid (H_2SO_4) due to the presence of both moisture (H_2O) and hydrogen sulfide (H_2S).
- Fugitive emissions of digester gas which contains between 900 and 1100 ppm of hydrogen sulfide (H_2S).
- Products of combustion from the burning of digester gas which contains between 1 and 2 ppm of sulfur oxides (SO_x).
- Chlorinated plant effluent which contains about 1 to 2 ppm of total chlorine residual.
- Caustic chemicals such as Sodium Hydroxide ($NaOH$)
- Oxidizing agents such as Potassium Permanganate ($KMnO_4$) and Sodium Hypochlorite ($NaClO$).

In designated Corrosive Areas, the Contractor will take the actions described below to protect the new equipment and materials from corrosion.

3.8.2 Fasteners and Hardware in Corrosive Areas

Fasteners are defined as nuts, bolts, washers, screws, studs, anchors, and threaded rods.

- All new fasteners in Corrosive Areas are to be 300 series stainless steel (such as 304 or 316).
- Exception: New threaded rods in Corrosive Areas are to be either:
 - 300 series stainless steel (such as 304 or 316) or;
 - 6000 Series Aluminum (such as 6061 or 6063).

Hardware is defined as channels, struts, supports, hangers, clamps, and any other associated accessories.

- All new hardware in Corrosive Areas are to be either:
 - 300 Series Stainless Steel (such as 304 or 316) or;
 - 6000 Series Aluminum (such as 6061 or 6063) or;
 - Approved high-strength composite materials such as glass-fiber reinforced plastic.Acceptable composite materials include:
 - Unistrut, Fiberglass Strut System;
 - Aickinstrut, Fiberglass Strut System;
 - Other equivalent product that complies with the requirements of ASTM D3917 and ASTM D4385.

Contractor is to follow the manufacturer's instructions regarding loading of fasteners and hardware. Contractor will coordinate with the Engineer for approval to re-use any existing fasteners or hardware. Any re-used fasteners or hardware that is not stainless steel or aluminum is to be painted or coated in accordance with Sections 3.8.8 and 3.8.9.

3 Common Requirements for All Bid Items

3.8 Corrosion Protection (continued)

3.8.3 Recommended Metals in Corrosive Areas

The following metals hold up well in Corrosive Areas and do not need to be painted or coated:

- 300 series stainless steel. These metals might be referred to by any of the following designations:
 - 18-8 or equivalent alloys containing about 18% chromium and 8% nickel.
 - Type 304 or CF8 or A2 stainless.
 - Type 316 or CF3M or A4 stainless.
- Aluminum alloys that contain less than 1% copper such as most extruded aluminum (which are generally 1000 series, 6000 series, or 7000 series) and most other cast aluminum.
- Nickel Alloys
- Electroplated steel with a plating of either aluminum or nickel.
- Hot Dip Galvanized steel that is fabricated in accordance with ASTM A385, galvanized in accordance with ASTM A123, assembled using hardware in accordance with ASTM A153, and repaired in accordance with ASTM A780 is acceptable in corrosive areas.

3.8.4 Metals to Avoid or Protect in Corrosive Areas

The following metals are susceptible to corrosion in Corrosive Areas. The Contractor will avoid these metals for any exposed components or provide other means of painting or coating these metals:

- Copper, lead, silver, zinc.
- Copper alloys such as brass, bronze, and cupronickel.
- Chrome-plated or nickel-plated brass.
- Other zinc coating are not acceptable for corrosive areas. These include galvanized sheet (ASTM A653), mechanical plated (ASTM B695), electrogalvanized (ASTM A879), and zinc plated (ASTM B633) materials. These may also be referred to as zinc-plated, electroplated, zinc electrogalvanized, zinc electroplated.
- Alloys that contain significant amounts of copper such as Monel and COR-TEN.
- Aluminum alloys that contain more than 1% copper such as 2000 series wrought aluminum, 200 series cast aluminum, and 319 cast aluminum.
- Solder containing lead, tin, or silver.

3.8.5 Dissimilar Metal Connections in Corrosive Areas

Dissimilar Metal Connections are defined as the connection of any group listed in the table below with any other group.

Copper Group	Copper or any copper alloys such as brass or bronze.
Ferrous Group	Iron or any iron alloys such as black steel, carbon steel, galvanized steel, or zinc-plated steel.
Aluminum Group	Aluminum or any aluminum alloys.

Corrosion can be expected if the Dissimilar Metal Connections are left exposed in Corrosive Areas. The Contractor will avoid Dissimilar Metal Connections or use the following methods to avoid corrosion:

- Provide an electrically insulating material between dissimilar metals. Suitable materials include: vinyl electrical tape or nitrile rubber gasket material.
- Provide PTFE thread seal tape on threaded connections.

3 Common Requirements for All Bid Items

3.8 Corrosion Protection (continued)

- Provide field-applied corrosion inhibitor between the connected metals or over the entire connection area. Contractor will use a field-applied corrosion inhibitor as specified in Section 3.8.9.

3.8.6 Corrosion Protection of All Metal

Contractor will provide painting or coating on all exposed metal components of the new equipment and materials in Corrosive Areas. See Section 3.8.3 regarding metals that do not need to be painted or coated. See Section 3.8.9 regarding metal parts that are not appropriate to paint.

3.8.7 Factory-applied Paint or Coating for Equipment in Corrosive Areas

- Contractor will ensure that the factory-applied paint or coating on new equipment in Corrosive Areas is approved by the manufacturer as suitable for use in a wastewater facility. One primer coat by itself is not acceptable. Contractor will bear the cost of any upgraded paint or coating system to meet this requirement.
- Contractor will provide touch-up repair of any factory-applied paint that is damaged during the installation process. Contractor will use paint as specified in Section 3.8.8 for any needed touch-up painting.

3.8.8 Field-applied Paint in Corrosive Areas

- In Corrosive Areas, Contractor will provide field-applied paint to all new metal.
- Exceptions:
 - Do not paint data plates or equipment labels.
 - Metals listed in Section 3.8.3 do not need to be painted.
 - Metals that are not appropriate to paint should be coated with a field-applied corrosion inhibitor instead. See Section 3.8.9.
 - Contractor will coordinate with the Engineer for approval any other metals that do not need to be painted.
- Acceptable paints include the following:
 - Tnemec, Series N69, Hi-Build Epoxoline II
 - Sherwin-Williams, Macropoxy 646 Fast Cure Epoxy
- Contractor will follow the paint manufacturer's instructions for paint application and dry film thickness.
- Contractor will match the new paint color to be the same color as the existing equipment or the same as other similar equipment. Light-gray (ANSI #70) is also an acceptable color for new equipment.
- Contractor will follow the paint manufacturer's instructions for surface preparation, but as a minimum will remove all oil, grease, dirt, loose rust, loosely adhering paint, and other foreign matter by hand or power tool cleaning per SSPC-SP2 or SSPC-SP3. Strongly adhering paint or asphalt coatings do not need to be removed. Note: SSPC-SP2 is an abbreviation for the Society of Protective Coatings, Surface Preparation standard #2 for Hand Tool Cleaning. SSPC-SP3 is an abbreviation for Surface Preparation standard #3 for Power Tool Cleaning.
- Contractor will overlap paint slightly onto any exposed adjacent metal that is part of the current facility equipment so that the interface between new metal and old metal is protected by paint.

3 Common Requirements for All Bid Items

3.8 Corrosion Protection (continued)

3.8.9 Field-applied Corrosion Inhibitor in Corrosive Areas

- In Corrosive Areas, Contractor will provide a light coat of white lithium grease or other corrosion inhibitor to all new metal that is not appropriate to paint. These include:
 - Moving parts (or parts that are intended to move)
 - Threaded connections
 - Threaded rods
 - Valve stems
 - Sliding metal parts
 - Electrical conduit joints
 - Electrical conduit hubs
 - Any other connections that are intended to be removable.
- Exceptions:
 - Metals listed in Section 3.8.3 do not need to be coated.
 - Contractor will coordinate with the Engineer for approval any other metals that do not need to be coated.
- Acceptable corrosion inhibitors include the following:
 - White Lithium Grease (from any company)
 - WD-40 Long Term Corrosion Inhibitor
 - CRC Heavy Duty Corrosion Inhibitor
 - Corrosion X
 - Fluid Film

3 Common Requirements for All Bid Items

3.8 Corrosion Protection (continued)

3.8.10 Corrosion Protection of Electrical Equipment

The contractor will take the actions described below to protect new electrical equipment in designated Corrosive Areas.

- 3.8.10.1 In Corrosive Areas, Contractor will provide a Complete Electrical System that is protected to a "Watertight" level as defined by the National Electrical Manufacturers Association (NEMA). The Complete Electrical System consists of the new electrical equipment combined with any previously-installed facility equipment.

Acceptable conduit for use in Corrosive Areas

Contractor will use the following types of conduit in Corrosive Areas:

- Rigid Aluminum Conduit (RAC) also known as: Aluminum Rigid Conduit (ARC); or Electrical Rigid Aluminum Conduit (ERAC); or Electrical Rigid Metal Conduit - Aluminum (ERMC-A)
- Liquidtight Flexible Metal Conduit (LFMC).

Rigid Aluminum Conduit (RAC)

Rigid Aluminum Conduit (RAC) is to be Underwriters Laboratories (UL) listed to Safety Standard 6A; manufactured in accordance with ANSI C80.5 and installed in accordance with NEMA and NEC guidelines. Proper installation procedures should be used with Rigid Aluminum Conduit to avoid corrosion issues with dissimilar metals. See Section 3.8.5 regarding dissimilar metals.

Liquidtight Flexible Metal Conduit (LFMC)

Liquidtight Flexible Metal Conduit (LFMC) is to be installed in accordance with NEMA RV 3 (latest version), which addresses the application and installation of LFMC.

Fittings for LFMC

Fittings for LFMC are to be installed in accordance with NEMA FB 2.20 (latest version), which addresses the selection and installation of fittings for use with LFMC. Fittings for LFMC should be mounted horizontally or from underneath termination boxes to allow liquids to run away from the fittings. Fittings for LFMC should not be mounted on the top of boxes as this may allow liquids to flow through loose fittings into electrical boxes.

- 3.8.10.2 In Corrosives Areas, Contractor will ensure that new NEMA 4X enclosures comply with the following:

- are installed properly in order to retain their rating.
- are mounted by means external to the enclosure cavity.
- have gasketed conduit fitting for watertight connection at the conduit entrance.

3.8.10.3 Conduit Types Not Allowed In Corrosive Areas

The following conduit types are not allowed in Corrosive Areas:

- Electrical Metallic Tubing (EMT)
- Intermediate Metal Conduit (IMC)
- Flexible Metal Conduit (FMC)
- Flexible Metallic Tubing (FMT)

3 Common Requirements for All Bid Items

3.9 Electrical Requirements

- 3.9.1 All work is to be in compliance with National Electric Code, NFPA 70. In Corrosive Areas, Contractor will provide corrosion protection of electrical equipment as specified in Section 3.8.
- 3.9.2 All work is to be in compliance with OSHA Standards. Disconnect switches must be installed in accordance with OSHA Standard 1910.147 and designed to accept a lockout device.
- 3.9.3 Contractor will provide new disconnect switches for all new equipment that is required by OSHA to have disconnect switches.
- New equipment that has an integral disconnect switch in accordance with OSHA Standard 1910.147 is acceptable.
 - If new equipment that does not have an acceptable switch, then Contractor will provide a new local disconnect switch that is in accordance with OSHA Standard 1910.147. For new equipment in a Corrosive Area, the disconnect switch will be of stainless steel or glass-fiber reinforced plastic construction meeting NEMA 4X standards. See Section 3.8.10.2 regarding NEMA 4X enclosures.

3 Common Requirements for All Bid Items

3.10 Equipment Identification Tags

3.10.1 Contractor will provide and attach new Equipment Identification Tags for the following:

- New equipment.
- New or existing ancillary devices associated with the new equipment identifying the equipment that it controls or provides power to including:
 - Motor Start/Stop Switches
 - Electrical Disconnect Switches
 - Control Panels
 - Thermostats

3.10.2 Tags will be made from 1/16 inch thick, laminated impact acrylic such as Rowmark UltraMattes 322-512, or equivalent. Tags are to be blue with white letters.

3.10.3 Tags will be positioned on the equipment so they are easily visible from a normal avenue of approach. The minimum size requirements are listed below. Larger tags and text are also acceptable.

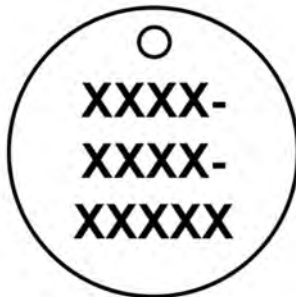
3.10.4 Tags for General Equipment

- Rectangular, 3-½ inch wide by ¾ inch high.
- One line of text, centered, with white capitalized block letters 1/4" high.
- Attached with permanent adhesive.



3.10.5 Tags for Valves and Gates

- Round, 1-½ inch diameter, with small hole at the top for tie wire.
- Three lines of text, centered, with white capitalized block letters 3/16" high.
- Attached with permanent stainless steel tie wire.



3 Common Requirements for All Bid Items

3.10.6 Equipment Identification Tag Numbers

Bid Item	Equipment Location	Equipment Name	Equipment Identification Tag Number
6	Digester 1&2 Building	Sludge Valve	Later
6	Digester 1&2 Building	Sludge Valve	Later
6	Digester 1&2 Building	Sludge Valve	Later
6	Digester 1&2 Building	Sludge Valve	Later
6	Digester 1&2 Building	Sludge Valve	Later
6	Digester 1&2 Building	Sludge Valve	Later
6	Digester 1&2 Building	Sludge Valve	Later
7	Digester 1&2 Building	Foam Detecting Radar	Later
10	Digester 1&2 Building	Digester Gas Valve	Later
10	Digester 1&2 Building	Digester Gas Valve	Later
10	Digester 1&2 Building	Digester Gas Valve	Later
10	Digester 1&2 Building	Digester Gas Valve	Later
10	Digester 3&4 Building	Digester Gas Valve	Later
10	Digester 3&4 Building	Digester Gas Valve	Later
10	Digester 3&4 Building	Digester Gas Valve	Later

3 Common Requirements for All Bid Items

3.11 Clean-up

Contractor will take steps to ensure the work sites are kept reasonably neat and clean throughout the project. Contractor will remove all excess material and debris upon completion of Work at each site.

3.12 Payment

- Contractor will refer to Paragraph GC-29 of the *General Conditions of Contract* regarding partial payments. 5% retainage of the dollar amount of the contract is required by Paragraph GC-29.
- In addition to the 5% retainage listed above, the Engineer will withhold the following percentage of the dollar amount of each Bid Item:
 - 20% for:
 - Documents for Record,
 - Start-up of Equipment,
 - Training Service (if required).
 - 5% for:
 - Final Acceptance of the Work,
 - Equipment Identification Tags.
- The Mobilization Allowance is subject the 5% retainage that is required by Paragraph GC-29, but the Engineer will not withhold any portion of the Mobilization Allowance. The Contractor may request payment of the Mobilization Allowance immediately after receipt of the order to proceed with work.

4 Specific Requirements for Each Bid Item

4.1 Bid Item 1

	Item Description
Bid Item 1	<u>Cleaning of Digester 1</u> at the Southside Wastewater Treatment Plant. This includes: removal of residual material; wash down of internal surfaces; flushing of pipes; and cleaning of sludge mixers.

4.1.1 Background Information

- Digester 1 is operated as a primary digester which means that it receives raw sludge directly from the gravity thickener complex.
- Cleaning of the digester is necessary because grit and heavy debris settle to the bottom while scum (which consists of fat, oil, grease, and buoyant trash) remains floating near the top. The grit and scum accumulate and, over time, significantly reduces the operational volume of the digester.
- Digester 1 was last cleaned in 2015 as part of project ES 2010-04, Contract 2.

4.1.2 Summary of Proposed Work

- The plant staff will take the digester out-of-service. This includes the following:
 - Stop the raw sludge feed to Digester 1.
 - Continue to heat and recirculate the sludge to allow the digestion process to continue until digester gas production has significantly decreased.
 - Isolate the Digester 1 gas piping system to ensure that gas from Digester 2 (in-service) cannot flow into Digester 1 (out-of-service).
 - De-pressurize the digester and allow natural ventilation of the digester.
 - Drawdown the liquid sludge in Digester 1 to the appropriate side-wall height using existing facility equipment.
 - Isolate the Digester 1 sludge piping to ensure that sludge from Digester 2 (in-service) cannot flow into Digester 1 (out-of-service).
 - Start monitoring groundwater levels.
- The Engineer will calculate the volume of residual material inside the digester as addressed in Bid Item 2 of this contract.
- The Contractor will:
 - Remove the two (2) top-access hatches and replace them with grating or other type of cover to provide fall-through protection. Purpose is to increase day-light into the digester and increase natural ventilation of the digester.
 - Remove the one (1) side-access hatch.
 - Provide mechanical ventilation of the digester.
 - Remove and dispose the residual material from the digester.
 - Washdown the interior surfaces of the digester with flushing water.
 - Flush the inside of the sludge decant box and five (5) connected pipes.
 - Flush the five (5) lower pipes located at the bottom of the digester.
 - Clean and service the four (4) sludge mixers in accordance with Bid Item 4 of this contract.
 - Prepare the digester for inspection in accordance with Bid Item 5 of this contract.
 - Replace the appropriate valves in accordance with Bid Item 6 of this contract.
- The Engineer will inspect the inside conditions of the digester. Based on the situation, the Engineer will decide to either:
 - return the digester to In-Service;
 - or keep the digester Out-of-Service.

4 Specific Requirements for Each Bid Item

4.1.3 Contractor's Responsibility

- Refer to Section 3.1 of the *Common Requirements for All Bid Items* for Contractor's Responsibility.
- Work on this bid item is considered a Significant Event and requires coordination with plant operations. See Section 3.2 of the *Common Requirements for All Bid Items*.
- WARNING: Digester gas contains between 60 to 65% methane which is flammable. When mixed with air, it can be explosive.
- WARNING: Digester gas contains between 3,000 and 4,000 ppm of Hydrogen Sulfide. Inhalation of digester gas can cause rapid unconsciousness, immediate collapse within 1 to 2 breaths, stop of breathing, and death within minutes.
- While work is being done, the area must be continuously ventilated to remove or dilute digester gas; Contractor is responsible for providing ventilation equipment.
- While work is being done, the air must be continuously monitored for the presence and concentration of hydrogen sulfide and methane using a multi-gas meter that detects both gases; Contractor is responsible for providing air monitoring equipment.
- If the hydrogen sulfide levels cannot be reduced to a safe level (as define by OSHA - Occupational Safety and Health Administration), workers must use appropriate respiratory protection and any other necessary personal protective equipment, rescue and communication equipment. Contractor is responsible for providing any needed equipment.
- Contractor is to provide and install a temporary plug in the sludge overflow drain pipe. The purpose is to prevent sewer gasses (from the plant sewer) or digester gas (from Digester 2) from entering into Digester 1. This plug is to be installed anytime there are people working inside Digester 1.
- Contractor shall have sole responsibility and risk for the following:
 - Extraction of residual material from the digester;
 - Screening of trash from the residual material;
 - Temporary storage of material on-site (if applicable);
 - Dewatering of material on-site (if applicable);
 - Proper disposal of filtrate (if applicable);
 - Proper disposal of residual material and trash in accordance with Bid Item 2 and Bid Item 3 of this contract.

4.1.4 General

- Drawing 1-1 is a plan view of the digester and shows the pipes located at the bottom of the digester.
- Drawing 1-2 is an elevation view of the digester and shows some of the pipes at the bottom of the digester.
- Drawing 1-3 is a plan view of the digester and shows the ceiling support columns that were added after original construction.
- Drawing 1-4 is an elevation view of the digester and shows the ceiling support columns, concrete ceiling, and steel gas dome that were added after original construction.
- Drawing 1-5 shows the steel gas dome.
- Drawings 1-6, 1-7, and 1-8 shows the sludge decant box and the five (5) connected pipes.
- Drawing 1-9 shows the external draft tubes and the sludge mixer assemblies.
- Drawings 1-10 is a simple sketch that shows important elevations within the digester.

4 Specific Requirements for Each Bid Item

4.1.5 Access Hatches

Digester 1 has the following access hatches.

Nominal Size	Quantity	Type of Access	Location	Notes
42-inch	1	Top	Southwest side of roof	Actual inside diameter might be between 41" and 40".
36-inch	1	Top	East side of roof	Actual inside diameter might be between 35" and 34".
36-inch	1	Side	Ground level on east side	Actual inside diameter might be between 35" and 34".

4.1.6 Removal of Residual Material

- Contractor is to remove the residual material from the digester and dispose of it in accordance with Bid Item 2 and Bid Item 3 of this contract.
- The residual material is defined as everything that is left within the digester after the plant staff pumps down the liquid sludge contents to the appropriate side-wall height. See Bid Item 2 and Bid Item 3 for more details.

4.1.7 Washdown

- Contractor is to washdown all interior surfaces of the digester with large volumes of flushing water. The interior surfaces include: floor; walls; ceiling; ceiling support columns; external draft tubes and sludge mixer assemblies; pipes and pipe support structures.
- Remove all rags or debris that may be clinging to any interior parts of the digester.

4.1.8 Flushing Water

- Contractor is to use Plant Effluent Water (PEW) for flushing water. A 1-1/2 inch PEW connection is available in the Digester 1&2 Building on the east side of the ground floor.
- Contractor is to provide hoses and other necessary fittings in order to utilize the flushing water.
- The water pressure may not be sufficient for cleaning elevated locations (such as the ceiling). Contractor is to provide any needed equipment to boost the pressure of the flushing water.

4.1.9 Flushing of Sludge Decant Box and Five (5) Connected Pipes

- Contractor is to flush the sludge decant box and the five (5) pipes which are connected to the sludge decant box near the top of the digester. These pipes are 6-inch nominal diameter.
 - The three (3) decant pipes normally allow digested sludge to flow out of the digester and into the sludge decant box.
 - The sludge transfer gravity pipe normally allows digested sludge to flow out of the sludge decant box and into Digester 2.
 - The sludge overflow drain pipe normally allows excess sludge to flow out of the sludge decant box and to the plant sewer.
- The contractor may use an expanding drain cleaning bladder or other method to flush the pipes.

4 Specific Requirements for Each Bid Item

4.1.10 Flushing of Five (5) Lower Pipes

- Contractor is to flush the five (5) lower pipes located at the bottom of the digester. These pipes are 6-inch nominal diameter. These pipes include the following:
 - One (1) sludge recirculation suction pipe.
 - Three (3) sludge recirculation discharge pipes.
 - One (1) sludge transfer suction pipe (also known as the “shin knocker” pipe).
- The contractor will have access to these pipes when the sludge valves in the basement of the Digester 1&2 building are removed. The replacement of these valves is addressed in Bid Item 6 of this contract.
- There are multiple existing PEW connections in the Digester 1&2 building that can be used for flushing.
- The contractor may use an expanding drain cleaning bladder or other method to flush the pipes.
- The slurry of flushing water combined with residual material is to be removed from the bottom of the digester and disposed in the same manner as the other residual material.

4.1.11 Groundwater

Groundwater under the digester complex fluctuates with rainfall and river level. The plant staff will monitor groundwater levels throughout the project. If the groundwater level rises to certain levels it will exert tremendous upward buoyant forces on the bottom of the digester and the basement of the building. Based on the situation, the Engineer may make the decision to stop Work and may direct the Contractor to flood the digester with Plant Effluent Water (PEW) to prevent structural damage to the digester complex.

4.1.12 Completion of Work

The Engineer will inspect the inside conditions of the digester, including the condition of the ceiling and the external draft tube mixers. Based on the situation, the Engineer will decide to either:

- return the digester to In-Service;
- or keep the digester Out-of-Service.

Both situations are addressed below.

4.1.13 Return Digester to In-Service

If the Engineer decides to return the digester to In-Service, then the Contractor will:

- Remove all scaffolding, lighting and ventilation equipment.
- Reinstall the access hatches with new gaskets.
- Contractor may reuse the existing bolts and nuts for the access hatches if they are in good condition. Contractor will provide new bolts and nuts for the access hatches if they are not suitable for reuse.
- Take any other necessary steps to prepare the digester to be placed back In-Service.
- Contractor will re-paint the outer surface of the one (1) side-access hatches near ground level. It should be painted in accordance with Section 3.8.8 of the *Common Requirements for All Bid Items*. The top-access hatches do not need to be painted.

4 Specific Requirements for Each Bid Item

4.1.14 Keep Digester Out-of-Service

If the Engineer decides to keep the digester Out-of-Service, then the Contractor will:

- Leave the access hatches open.
- Provide (but do not install) new gaskets for the access hatches.
- With regard to scaffolding, lighting and ventilation equipment, the Contractor may elect to remove this equipment or leave it in-place since this equipment may be used by the Contractor to facilitate potential repairs to the digester.

4.1.15 Potential Repair of Digester

If the digester needs to be repaired, the Engineer may decide to keep the digester Out-of-Service. In order to complete the repairs, the Authority may:

- utilize the Extra Work Allowance (under this contract);
- issue a Change Order (to this contract);
- or issue a new contract.

The Authority may finalize this contract and issue a new contract to a different general contractor.

4 Specific Requirements for Each Bid Item

4.2 Bid Item 2 and Bid Item 3

	Item Description
Bid Item 2	Proper disposal of <u>Residual Material</u> in Digester 1. This bid item is a unit price per cubic yard. For bidding purposes, the estimated volume of Residual Material is 3,100 cubic yards.
Bid Item 3	Proper disposal of <u>Trash</u> in Digester 1. This bid item is a unit price per cubic yard. For bidding purposes, the estimated volume of Trash is 110 cubic yards.

4.2.1 Definitions

The following definitions apply to these two bid items:

- Residual Material is defined as everything that is left within the digester after the plant staff draws down the liquid sludge contents to the appropriate side-wall height.
 - The residual material consists of trash (defined below) and the remaining material (defined below).
 - The composition of the residual material is estimated below. The actual composition within will be different.
 - 48% volume of water that could be separated with dewatering equipment.
 - 48% blend of wet sand and wet organic material in a liquid state, or a semi-liquid state, or a semi-solid state that could be dewatered to produce a semi-solid cake with total solids content between 15% and 50% on a mass basis.
 - 4% volume of trash that should be screen out and compacted.
- Trash is defined as materials that are not suitable components of good quality Class B Biosolids.
 - The trash will include the following: rocks, grit, concrete fragments, brick fragments, metal fragments, metal hardware, broken pipe fragments, construction debris, congealed fat and grease, food scraps, rags, plastic shopping bags, towelettes, paper towels, facial tissues, baby wipes, makeup wipes, disinfecting surface wipes, floor cleaning mop refill wipes, toilet cleaning wipes, scrubbing pads, dryer sheets, feminine hygiene products, diapers, condoms, contraceptives, bandages, dental floss, hair, ear swabs, cotton balls, rubber gloves, syringes, needles, sharp objects, plastic bottles, plastic bottle caps, food wrappers, absorbent pads, clothing, sheets, socks, towels, wash clothes, plastic objects, golf balls, toys, and many other interesting items.
 - The trash will also include large masses of fibrous, stringy, and ropey material intertwined with debris.
- Remaining Material is defined as the cleaner material that is produced by screening the trash out of the residual material.
 - The Remaining Material consists of materials that are suitable components of Class B Biosolids. This includes the following:
 - Class B Biosolids;
 - blend of sand and organic material with a “soil-like” consistency that can be mixed with other biosolids to create a good quality Class B Biosolids;
 - a significant amount of water;
 - a significant amount of sand.
 - The remaining material should not contain a significant amount of visible trash nor any particles of trash larger than 3/8 inch.

4 Specific Requirements for Each Bid Item

4.2.2 Summary of Proposed Work

- The plant staff will take the digester Out-of-Service as described in Bid Item 1.
- The Engineer will calculate the volume of residual material inside the digester as describe below.
- The actual pay quantity for Bid Item 2 will be based on the measured volume of residual material in the digester.
- The Contractor will remove the residual material as described in Bid Item 1.
- The Contractor will screen out the trash from the residual material as described below.
- The Contractor will measure the volume of trash as described below. The actual pay quantity for Bid Item 3 will be based on the actual measured volume of trash.
- The Contractor will dispose of the trash as described below.
- The Contractor will dispose of the remaining material as described below.

4.2.3 Contractor's Responsibility

- Refer to Section 3.1 of the *Common Requirements for All Bid Items* for Contractor's Responsibility.
- Contractor shall have sole responsibility and risk for the following:
 - Extraction of residual material from the digester;
 - Screening of trash from the residual material;
 - Temporary storage of material on-site (if applicable);
 - Dewatering of material on-site (if applicable);
 - Proper disposal of filtrate (if applicable);
 - Proper disposal of residual material and trash.
- Contractor shall comply with all legal requirements regarding the transportation of the residual material and trash.
- Contractor shall comply with all Oklahoma Department of Environmental Quality (ODEQ) requirements regarding the proper disposal of the residual material and trash.
- Contractor is responsible for all ODEQ paperwork requirements.
- Any fines imposed on the Authority by any regulatory agency as a result of the Contractor's noncompliance with environmental regulations shall be paid or reimbursed by the Contractor.

4 Specific Requirements for Each Bid Item

4.2.4 Measurement of Residual Material

- The actual volume of residual material will be calculated by the Engineer. The volume will be calculated before any flushing water is added or any residual material is removed by the Contractor.
- There are different ways the volume may be calculated based on the situation. If the surface of the bulk residual material is relatively flat, then simple measurements from access hatches may allow determination of the sidewall height. Other situations may justify other calculation methods. All calculation will be made available to the Contractor. The payable quantity (in cubic yards) should be mutually agreeable between the Engineer and the Contractor.
- The estimated volume of residual material is 3,100 cubic yards which is equivalent to a sidewall height between 6 and 7 feet.
- The table below is provided for information only and shows the correlation between sidewall height and volume inside Digester 1. The volumes listed below are based on the simple geometry of a cylinder. It is assumed that the additional volume from the external draft tubes and the reduced volume from the ceiling support columns cancel each other and are negligible.

Sidewall Height (feet above cone)	Volume (cubic yards)
0	1,211 (volume in cone)
1	1,502
2	1,793
3	2,083
4	2,374
5	2,665
6	2,956
7	3,246
8	3,537
9	3,828
10	4,119
11	4,409
12	4,700
13	4,991
14	5,282
15	5,572
16	5,863
17	6,154
18	6,444

4 Specific Requirements for Each Bid Item

4.2.5 Screening Trash out of the Residual Material

- Contractor will provide screening equipment to separate the trash from the residual material.
- The maximum screen opening shall be 3/8 inch.

4.2.6 Measurement of Trash

- Contractor will measure the volume of trash in cubic yards.
- There are different ways the volume may be calculated based on the situation. The payable quantity (in cubic yards) should be mutually agreeable between the Engineer and the Contractor.

4.2.7 Disposal of Trash

- Contractor will coordinate directly with the landfill operator.
- Contractor will properly transport and dispose the trash at the landfill.
- Contractor will pay for all transportation and landfill expenses.

4.2.8 Proper Disposal of Remaining Material

- Proper disposal of remaining material may include any combination of the methods listed below and described in the subsequent sections:
 - Contractor Coordinated Land Application
 - City of Tulsa Coordinated Land Application

4.2.9 Contractor Coordinated Land Application

- Contractor will coordinate directly with the landowner.
- Contractor will transport the biosolids to the landsite. The biosolid may be in a liquid state or a semi-solid state that is acceptable to the landowner.
- Contractor will comply with all Oklahoma Department of Environmental Quality (ODEQ) requirements and other legal requirements and follow proper procedures for land application of biosolids.

4.2.10 Dewatering of the Remaining Material

If the Contractor elects to dewater the residual material on-site, then the following applies:

- Contractor will provide containment for any polymer or polymer dosing equipment.
- Contractor will provide containment for dewatering equipment.
- Filtrate (liquid) and screened flushing water, with less than 250 mg/L Total Suspended Solids (TSS), may be discharged into the plant sewer.
- Dewatering shall be completed in a manner that does not impede facility operations or cause a facility upset.

4 Specific Requirements for Each Bid Item

4.2.11 City of Tulsa Coordinated Land Application

- This method of disposal is contingent upon the composition of the material. Acceptable material includes the following:
 - Good quality Class B Biosolids Cake that has been properly dewatered to a semi-solid cake and is suitable for land application.
 - A blend of sand and organic material with a “soil-like” consistency that has been properly dewatered to a semi-solid cake and can be mixed with other biosolids cake to create a good quality Class B Biosolids Cake that is suitable for land application.
 - The material should not contain a significant amount of visible trash nor any particles of trash larger than 3/8 inch.
- Contractor will provide dewatering equipment, polymer, and polymer dosing equipment to produce a cake with a total solids content greater than or equal to 15 percent on a mass basis.
- Contractor will transport and unload the cake into a designated drying bed at the 71st Street Facility for inspection.
- The City of Tulsa will coordinate land application of the biosolids through its normal biosolids land application program.

4 Specific Requirements for Each Bid Item

4.4 Bid Item 4

	Item Description
Bid Item 4	Remove, clean, and service the four (4) <u>Sludge Mixers</u> of Digester 1. This includes replacing the upper and lower bearings. This work is to be coordinated with the cleaning of Digester 1.

4.1.1 Background Information

- The primary purpose of the sludge mixing system is blend the sludge within the tank to help provide ideal conditions for the microorganisms.
- The sludge mixing system was installed in 2015 as part of project ES 2010-04, Contract 2. The mixers have been running continuously since start-up.
- This project will be the first time that these mixers will be cleaned and serviced.

4.4.2 Definitions

- Digester 1 has four (4) Sludge Mixers and they each consist of two (2) separate parts, the Mixer Assembly and the Draft Tube.
- The Mixer Assembly includes the following:
 - impeller and shaft with upper and lower bearing housings;
 - shaft housing with deflector;
 - drive motor with belt drive system.
- The Draft Tube consists of large diameter pipe that provide a passage for sludge to be pumped through by the impeller. The draft tube is a permanent part of the digester.
- The mixer assembly is mounted atop the draft tube and impeller is inserted into the upper section of the draft tube. The mixer assembly (with impeller) can be removed from the draft tube for cleaning and service.
- WesTech Engineering is the manufacturer of the sludge mixers and they have provided instructions for the removal, service, inspection, and re-installation of the sludge mixers.

4.4.3 Summary of Proposed Work

Contractor is to do the following for each sludge mixer:

- Remove the mixer assembly from the draft tube in accordance with the WesTech instructions. Coordinate with the Engineer to conduct a preliminary inspection of the existing conditions of the mixer assembly and the shaft straightness before it is lowered to the ground.
- Lower the mixer assembly to the ground and avoid resting the impeller on the ground by using a strap to lift the impeller end with a forklift or a second crane hook.
- Provide proper support for the shaft and impeller once it is positioned horizontally on the ground.
- Clean all rags and debris from the mixer assembly.
- Replace the upper and lower bearings (and appropriate seals) in accordance with the WesTech instructions.
- Coordinate with the Engineer to conduct an inspection of the new bearings. Note that the mixer assembly needs to be lifted vertically to inspect the bearings.
- Clean all rags and debris from the draft tube.
- Notify the Engineer when the sludge mixer equipment has been cleaned and is ready for inspection.
- When permitted by the Engineer, re-install the mixer assembly into the draft tube in accordance with the WesTech instructions.
- Lubricate the bearings and prepare the sludge mixer for normal operation.

4 Specific Requirements for Each Bid Item

4.4.4 Inspection Period

- Contractor is to provide the mixer assembly and the draft tube for the Engineer, the Authority, or their representatives for inspection for a period of two (2) weeks.

4.4.5 Potential Repair of Sludge Mixers

If the sludge mixers need to be repaired, the Authority may:

- utilize the Extra Work Allowance under this contract;
- issue a Change Order to this contract;
- or issue a new contract to a different general contractor.

4.4.6 Contractor's Responsibility

- Refer to Section 3.1 of the *Common Requirements for All Bid Items* for Contractor's Responsibility.

4.4.7 General

- Drawing 4-1 shows the sludge mixer.
- Drawing 4-2 is a detailed view of the mixer assembly within the draft tube.
- Drawing 4-3 shows detail views of the upper and lower bearings.
- The Operation and Maintenance Manual for the sludge mixers is provided on the following pages.

Operation and Maintenance Manual

Revision: °

For:

Southside WWTP
Gas Digester Improvements
Tulsa, Oklahoma

Equipment:

Four 36" Diameter External Extreme Duty Sludge Mixers with 39"
Diameter Draft Tubes
Specification Section: 46 73 31
Model Number: SME1

WesTech Contact:

Project Manager: Michael Moe
Phone: (801) 290-5724
Email: mmoe@westech-inc.com

WesTech Job Number: 22397A
October 2015

The logo for WesTech, featuring the word "WESTECH" in a bold, blue, sans-serif font. The letters are slightly shadowed, giving it a 3D appearance. The logo is positioned in the bottom left corner of the page, above a horizontal bar that is grey on the left and orange on the right.

**For:**

Southside WWTP
Tulsa, Oklahoma

Equipment:

Four 36" Diameter External Extreme Duty Sludge Mixers with 39" Diameter Draft Tubes
Specification Section: 46 73 31
Model Number: SME1

Engineer:

Greeley & Hansen

Contractor:

Crossland Heavy Contractors
501 Southeast Avenue
Columbus, Kansas 66724
Contact: Rick Stevens
Phone: (918) 857-1614
Fax: (620) 429-2977

WesTech Agent:

Haynes Equipment Co.
117 Northwest 132nd Street
Oklahoma City, Oklahoma 73114
Contact: Tony Moraska
Phone: (405) 755-1357
Fax: (435) 755-6493
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Manufacturer:

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22397A, #082015

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Warning Summary

Read this warning summary page before erecting and operating the equipment. The procedures must be followed as WesTech will not accept responsibility for damage to the equipment which has not been handled in accordance with the manufacturer's instructions. A brief summary of the warnings are listed below. For additional information please refer to the related sections.

Warning: Operating and maintaining this equipment has inherent risks. It is your responsibility to read and understand the Operation and Maintenance Manual prior to working with the equipment. This page is intended to summarize the warnings associated with WesTech's equipment. Where equipment manufactured by others has been provided in conjunction with WesTech equipment, additional warnings specific to that piece of equipment may only be contained in that section of the Manual. Please read and understand all warnings provided in this Manual.

Section Two: Installation of the Draft Tubes

Note: It is critical that the elbows are located at the correct elevations, that the distance between them is within 1/8 inch of the required dimension, that they are installed level with vertical center-lines in line with each other, and that the longitudinal center-lines are exactly on the tank radial line about which the anchor bolts were set. If any of these are done incorrectly, the draft tube will not fit. Therefore, do not embed the elbows in concrete until after the draft tube is installed and leveled to ensure proper alignment.

Note: Do not grout between the base plate and the rough concrete until the final leveling procedures are complete.

Section Two: Installation of Sludge Mixer Assembly

Note: Check v-belt to ensure they are at equal and proper tension. This tension should be checked frequently during the first 50 hours of operation. Place the cover on the belt guard.

Section Two: Electrical Installation

Note: All work is to be done in accordance with local and national electrical codes.

Section Three: Safety Precautions

1. Make sure that the power is off before performing any work on this equipment.
2. It is the responsibility of the contractor, installer, owner and user to install, maintain and operate the equipment manufactured and or supplied by WesTech Engineering, Inc. in such a manner as to comply with O.S.H.A. and all state and local regulations.
3. Only trained operators who have been schooled in safety procedures should be allowed to work on or around this equipment. Exercise caution around moving parts. In general, limit access to authorized personnel only.
4. Anyone entering the area should be wearing adequate safety equipment, such as safety glasses, safety shoes, hard hats, etc.
5. Inside of the digester is considered a confined space. Safety procedures for confined spaces must be adhered to.
6. The digester produces hazardous methane gas which is explosive. Therefore, all applicable codes and regulations must be adhered to.
7. No Smoking. Workers shall absolutely not smoke within 50 feet of the digester or gas equipment.
8. All electrical equipment used shall be of an explosion-proof type.
9. Non sparking tools shall be used on the digester.
10. Keep people away from the equipment who have been drinking alcohol, using drugs, or otherwise impaired.
11. Inspect equipment frequently for loose bolts or malfunctioning of assemblies. Address any problems in an expeditious manner.
12. It is important that personnel safety be stressed. DO NOT perform any repairs on moving parts.
13. Prior to working on rotating equipment, make sure that the mixer is turned off.
14. Assure that proper lockout tag-out procedures have been performed in order to avoid accidental operation during maintenance. All plant lockout tag out procedures must be followed while working on this equipment.

15. Ensure that there is a 60 second delay whenever the mixer changes direction. Allow the mixer to come to a complete stop before rotating in the opposite direction.

Section Four: Removal of Mixer Assembly

Note: Reinstalling the mixer uses the same procedure as the original installation. Please refer to Section Two entitled "Installation Instructions".

Section Four: Sludge Mixer Assembly Instructions

Note: Loctite has a 60 second cure time. You will need to install immediately after applying the Loctite.

Note: Verify that the match mark on the flow deflector (#113) aligns with the mark on the shaft housing (#104).

Note: Prior to operating the sludge mixer, grease the upper and lower bearing with #000 grease. Continue to grease the bearings until grease comes out of the relief fittings.

General Description

The digester mechanical sludge mixer is a good solution to mixing of digester sludge to obtain a more efficient process. This method of sludge mixing serves the following functions:

- promotes contact between the raw sludge feed and the micro-organisms
- distributes the buffering alkalinity throughout the tank, thus aiding pH control in the process
- minimizes the settling of dense inorganic solids contained within the raw sludge
- minimizes stratification in the digester of different densities and temperatures
- helps prevent volume reduction caused by scum accumulation
- has flexibility of rotation reversal, pumping in the downward and upward direction

This type of digester sludge mixer consists of three separate parts, the sludge mixer assembly, the seal tube, and the draft tube. The mixer assembly includes a drive motor, v-belt drives and guard, bearing housings, mixer housing, shaft, deflector, and impeller so designed that it can be removed from the draft tube and reinstalled without the necessity of draining the tank.

The draft tube and seal tube are long sections of pipe that are also essential for proper mixing. They are of a sufficient diameter such that the mixer impeller will fit inside the draft tube, providing a passage for the sludge to be pumped through. The seal tube is attached to the digester cover.

The draft tube is anchored to the floor of the digester tank and is removable only after the tank has been drained.

Service Platform

An optional service platform may be provided. The platform mounts at the top of the draft tube. Sufficient space is provided to all around access to the sludge mixer.

Scum Breaking

When used for the purpose of breaking up the scum blanket, the mixer should be run in the counterclockwise direction. This causes the scum to be drawn down into the draft tube. The scum is then mixed with the sludge and discharged out the bottom of the draft tube and dispersed throughout the digester contents. The scum breaking affect will be minimized if the tank contents are at high liquid level. If additional scum breaking is required, the liquid level should be lowered.

General Precautions

The erection instructions enclosed herewith are provided to assist in the assembly and adjustment of this mechanism. These procedures are suggested and are not intended to be substituted for the experience of the erector. Read the instructions prior to erecting and assembling the cover.

In the assembling of this equipment, it will be necessary to install, adjust, and maintain certain accessory items which are not manufactured by WesTech Engineering, Inc. This accessory equipment must be stored, handled, adjusted, and maintained in accordance with instructions provided by the manufacturer of that equipment. This is absolutely necessary in order to be assured of prompt and full participation in the warranty protection of the equipment. WesTech Engineering, Inc. will not accept responsibility for damage to equipment which has not been handled in accordance with the manufacturer's instructions.

Packing List

The Contractor's packing list consists of a sheet containing an itemized listing of parts.

The packing list contains:

1. A description of the part.
2. When applicable, nuts and bolts in bags will have item numbers written on bag.
3. The quantity of parts per assembled unit.
4. Total quantity of parts shipped.
5. Indication of direct shipment from supplier or fabricator.
6. Date and job number of shipment. The packing list will be found in one of the cartons which are shipped directly from Salt Lake City, Utah. The list should be kept in a readily accessible and safe place. Many contractors prefer to keep this list in some type of binder for protection and quick reference.

This list is particularly useful during erection for locating small parts and fasteners. When coordinated with the erection drawings, equipment tagging and piece marking, the contractor's packing list becomes an invaluable erection tool.

Equipment Tags

Each shipping piece has been tagged or piece marked for convenience. Typically, the part number and item number will be marked on all items. Piece marked items received will have a mark such as "Part No. 1021A or Item 101" which may be cross referenced through the parts list to a general erection drawing bubble number.

Unloading Equipment

Please handle the equipment properly when unloading and erecting. All cartons, electrical equipment, and gear drives should be stored under cover and protected from moisture, grit, and mud.

Painting

The material supplied for this job has been finish coated in the shop. It will require touchup due to handling and where field welding is necessary. A field touch up kit for the finish coatings has been provided by WesTech, however the field touch up is by others.

Fasteners

If stainless steel fasteners are used on this equipment, their threads must be coated with anti-seize before installation. Failure to do so may make installation difficult and future disassembly impossible. Anti-seize has been supplied with your order.

Safety

This equipment can cause serious injury or death if proper safety and operating procedures are not followed. Be sure that all operation and maintenance personnel have fully reviewed this manual and have been trained on the equipment.

Operation and Maintenance Manual

Keep an instruction manual in the area where the operators can familiarize themselves with it and have it for reference. This manual is essentially useless if the operator and foreman do not have access to it.

Further Assistance

If a problem is encountered in installing or operating the equipment, which cannot be solved by referring to this manual, feel free to contact:

WesTech Engineering, Inc.
3665 South West Temple
Salt Lake City, Utah 84115
(801) 265-1000 or Fax (801) 265-1080

Suggested Erection Sequence

The sequence listed below is suggested only and should not take precedence over the experience of the erector, if due to special circumstances or his equipment availability he should decide to vary this order or procedure.

1. Install the draft tubes
2. Install piping
3. Install platform
4. Install the mixer assemblies
5. Install electrical

Reference Drawings:

1011	General Arrangement
1012	Mixer Assembly Details
1013	Bearing Assembly Details
1014	Platform Assembly Details
1015	Platform Assembly Details
E10D	Panel Layout
E11D	Electrical Schematic
E12D	Electrical Schematic
E13D	Electrical Schematic
E14D	Electrical Schematic
E15D	Electrical Schematic
E16D	Electrical Schematic
E17D	Panel Layout Detail
E18D	Field Wiring Diagram

Parts List: 35658 Electrical
36928 Mechanical

Installation of the Draft Tubes

1. Place the inlet and discharge elbows in the tank.
2. Install the inlet and discharge elbows in the existing openings in the tank wall. Core drilling may be required for retrofit installations. The pipes should be placed in the wall openings and temporarily supported until they can be welded to the draft tube nozzles.
3. Layout the location for the draft tube base anchors as shown on Drawings 1011 and 1012.
4. Set the epoxy anchor bolts in accordance with the anchor manufacturer's instructions. Assure that there is a 4" projection above the concrete.
5. Allow the epoxy to cure for the specified time prior to applying any load. Do not disturb or load the anchors until the epoxy is fully cured.
6. Install the draft tube on leveling nuts and adjust so that the tube is level and plumb. Allow enough space for grout as shown on the assembly drawing.
7. Assure that the inlet and discharge are at the proper elevations. This may require minor adjustments at the anchor bolts.
8. Verify that the top flange of the draft tube is level in two directions, 90 degrees apart. The maximum out of level tolerance at the flange should not exceed 1/32".
9. Install the inlet and discharge nozzles so that they are aligned with the tank radial line.
10. After everything is level and plumb, tighten a top nut on each anchor bolt with a washer. Temporarily brace the top of the draft tube so that it cannot move while attaching the elbows.
11. Fit up the inlet and discharge elbows to the draft tube and level. Seal weld all around as shown on the assembly drawing.
12. Finally, verify that the top flange is still level as in Step 8 and that the draft tube is plumb. Grout under the baseplate with a non-shrink grout and place concrete fill around the embedment pipes as required by the project engineer. Let the grout and concrete cure as required before removing temporary bracing.

Note: It is critical that the elbows are located at the correct elevations, that the distance between them is within 1/8 inch of the required dimension, that they are installed level with vertical center-lines in line with each other, and that the longitudinal center-lines are exactly on the tank radial line about which the anchor bolts were set. If any of these are done incorrectly, the draft tube will not fit. Therefore, do not embed the elbows in concrete until after the draft tube is installed and leveled to ensure proper alignment.

Note: Do not grout between the base plate and the rough concrete until the final leveling procedures are complete.

Installation of Platform

1. Once the draft tube installation has been completed and the grout has cured, the platform can be installed.
2. Place the platform frame over top of the draft tube. Match up the bolt holes on the draft tube and bolt in place.
3. Bolt the beam in place.
4. Bolt the four braces in place.
5. Use the holes in the side of the platform frame next to the concrete tank as a pattern. Match drill into the concrete for the epoxy anchors.
6. Install the epoxy anchors. Allow the epoxy to fully cure before placing the nuts and washers on the anchor bolts.
7. Once the epoxy has cured, tighten the nuts.
8. Attach grating per the grating manufacturer's assembly drawing. (Grating **not** by WesTech)
9. Attach handrail per the handrail manufacturer's instructions and drawings. (Handrails **not** by WesTech).

Installation of Sludge Mixer Assembly

The sludge mixer assembly is shipped as a complete unit except for the impeller. See item 3. Some disassembly of the mixer may or may not be necessary to complete the installation.

Following is a recommended procedure and is not meant to forgo the experience of the individual assigned to the task of installing the equipment.

1. Verify that the top of the flange of the mixer frame is level in two directions, 90 degrees apart. The maximum out of level tolerance should not exceed 1/32".
2. Clean the draft tube flange and mixer assembly gasket surfaces and place a gasket in position on the flange bolts.
3. The mixer has been shipped with the impeller shipped loose. This is done to avoid bending the shaft in transit. The impeller must be installed in accordance with drawing (1012) using the key, impeller nut, and roll pin. The impeller shaft has been drilled to accept the roll pin. In order to assure correct installation with multiple units, each shaft has been match marked with its mating impeller and impeller nut. Also see sludge mixer assembly instructions located in the Maintenance and Parts section of this manual.
4. There are four lifting locations on the sludge mixer. Place lifting straps through the three holes in the mixer gussets. Connect these straps to the crane. The mixer is not symmetrically balanced; the weight of the motor causes the center of mass to not line up with the mixer centerline. Connect a come-along between the hole in the motor support and the crane hook.
5. Care must be taken to avoid resting the impeller on the ground during lifting. This can be done by running a strap around the flow deflector, just above the impeller, and lifting with a forklift or a second crane hook.
6. Slowly raise the mixer until it is completely off the ground. Tighten the come-along until the mixer is plumb.
7. Orient the mixer assembly as shown on the assembly drawings and carefully lower it into position. Exercise care when lowering the mixer to avoid damage to the impeller. The mixer assembly should extend into the draft tube with equal clearance all around the impeller.
8. Assure that the flow deflector is oriented properly and is in line with the inlet and discharge elbow of the draft tube.

draft tube flange. Then secure the mixer assembly fasteners coated with anti-seize.

9. Tighten the bolts in a pattern moving from one side at 0° and skipping to the opposite side at 180°. Then tightening the bolts at 90° and skipping to the opposite side at 270°. Continue this pattern until all bolts are tight.
10. Rotate the impeller shaft by hand to check if it rotates free.
11. Check that the upper and lower bearings have been properly lubricated. Lubrication instructions for the bearings are found in the Maintenance and Parts section of this Manual.

Note: Check v-belt to ensure they are at equal and proper tension. This tension should be checked frequently during the first 50 hours of operation. Place the cover on the belt guard.

Electrical Installation

1. All interconnecting wiring, conduit and supports are not provided by WesTech.
2. For electrical controls that were provided by WesTech, see the Electrical section of this manual.
3. Complete external wiring in accordance with wiring diagrams.

Note: All work is to be done in accordance with local and national electrical codes.

Safety Precautions

Make sure that the power is off before performing any work on this equipment.

It is the responsibility of the contractor, installer, owner and user to install, maintain and operate the equipment manufactured and or supplied by Westech Engineering, Inc. in such a manner as to comply with O.S.H.A. and all state and local regulations.

1. Only trained operators who have been schooled in safety procedures should be allowed to work on or around this equipment. Exercise caution around moving parts. In general, limit access to authorized personnel only.
2. Anyone entering the area should be wearing adequate safety equipment, such as safety glasses, safety shoes, hard hats, etc.
3. Inside of the digester is considered a confined space. Safety procedures for confined spaces must be adhered to.
4. The digester produces hazardous methane gas which is explosive. Therefore, all applicable codes and regulations must be adhered to.
5. **No Smoking.** Workers shall absolutely not smoke within 50 feet of the digester or gas equipment.
6. All electrical equipment used shall be of an explosion-proof type.
7. Non sparking tools shall be used on the digester.
8. Keep people away from the equipment who have been drinking alcohol, using drugs, or otherwise impaired.
9. Inspect equipment frequently for loose bolts or malfunctioning of assemblies. Address any problems in an expeditious manner.
10. It is important that personnel safety be stressed. **Do not** perform any repairs on moving parts.
11. Prior to working on rotating equipment, make sure that the mixer is turned off.
12. Assure that proper lockout tag-out procedures have been performed in order to avoid accidental operation during maintenance. All plant lockout tag out procedures must be followed while working on this equipment.

13. Ensure that there is a 60 second delay whenever the mixer changes direction. Allow the mixer to come to a complete stop before rotating in the opposite direction.

Operator Pre-start

1. Remove all foreign materials from inside the digester
2. Check the drive belts and verify correct adjustment. All parts should be alignment at proper tension with proper clearance at all points.
3. Lubricate the upper and lower shaft bearings and verify that pressure relief fittings are operable. Remove any foreign matter from the tank.
4. Verify that all bolted connections are tight.
5. After the mechanical checkouts, run the mixer while the tank is empty, observing it for 5 minutes; checking the amp readings on the motor, do this in both forward and backward directions to verify smooth operation.
6. Set the direction of rotation for forward. (See Mixer Flow Direction located in the Normal operation section of this manual).

Start-up

1. Fill the digester with water to maximum liquid level. Note: Take precautions in order to prevent damage to structures by the liquid stream.
2. The digester may now be pressure tested and checked for gas leaks.
3. Repair existing gas leaks before proceeding.
4. With water at maximum level run the mixer for one hour.
5. Verify that the amp readings on the motor do not exceed the motor's nameplate rating and verify smooth operation.
6. Stop the mixer for 60 seconds.
7. Reverse the direction of the mixer and run the mixer for one hour.
8. Check the amp readings on the motor and verify smooth operation similarly to step 5.

Normal Operation

1. Under normal operation, the direction of rotation of the mixer should be reversed for one hour during every twenty-four hour period.
2. Lubricate the upper and lower shaft bearings at regular intervals. (See Section IV, Lubrication and Maintenance.) The frequency will depend on the severity of operating conditions. Initially, lubricate weekly; if operating experience indicates less frequent lubrication would be satisfactory, change to bi-monthly and so on. In no case should lubrication intervals be greater than monthly.
3. The mixer's operation should be checked frequently, especially during the first few weeks. Check for smooth operation and for unusual noise, etc.
4. Frequent overload cut-out would indicate excessive load. Do not continue operation under overload conditions. Locate and correct the problem. Do not tamper in any way with electrical equipment.

Mixer Flow Direction

1. WesTech Sludge mixers are designed to pump in both directions causing the sludge flow to go in the upward and downward directions. The normal flow direction is based upon the site conditions and should be decided by those designated by the plant.
2. To determine the direction of sludge flow through the draft tube, look at the direction the sheaves are turning. If they are turning clockwise, the sludge flow is in the upward direction. If they are turning counter-clockwise, the sludge flow is in the downward direction. This is also known as the left-hand rule.

Emergency Operation

1. If the water level in the tank falls below the design level, the mixer should be stopped.
2. If the digester experiences excessive foaming, foam could possibly go through the pressure relief valve. The mixer should be stopped and the foaming problem corrected.
3. WesTech Engineering, Inc. can in no way anticipate all problems that could arise at any one particular plant. Plant personnel should monitor the digester and the mixer on a regular and frequent basis. Check for excessive vibration and unusual noise.

Equipment Maintenance

As with any piece of quality equipment, maintenance consists mainly of periodic inspection of those items which require painting, as well as those parts which are subject to wear during normal operation.

Usually, plants utilizing this type of equipment schedule regular maintenance periods, and these can be used for the inspection of those items. Periodic checks should be made to make certain that these units which require lubrication continuously are done so properly.

All bolts and nuts should be kept tight and original elements and adjustments maintained. Drive belts should be inspected for wear and proper alignment in conjunction with inspection of bolts and nuts. Inspection should be made at regular intervals.

ExtremeDuty Mixer Lubrication

A lubrication legend has been mounted on the mixer for easy reference. Lubrication points consist of one (1) grease fitting at the top of the assembly for the upper bearing, and one (1) grease fitting on the flange to grease the lower bearing (see Fig. 4.1 on the next page).

Lubrication Schedule

Grease upper and lower bearings weekly.

Lubrication Instructions

Grease each bearing by slowly working the grease pump handle until grease is visibly coming out of the grease relief fitting. If the temperature is below 10 degrees F – **pump the handle only 1-2 times.**

Used grease is caught in the grease drip pan, which must be emptied periodically.

Cold Weather Lubrication Instructions

When the outdoor temperature is 10 degrees F or less, pump the handle only 1-2 times. **Do not pump grease in until it relieves!**

In the colder temperatures it can be tempting to increase the pressure used with the grease pumps however forcing the thick cold grease too quickly into the fitting can result in damaged seals. Therefore it is important to **not** use too much pressure when greasing the mixers in colder temperatures.

Approved Lubricants

Mobil Oil Corp: Mobilux EP 023

Chevron: Dura-Lith EP 000

Citgo: Premium Lithium EP 000

Other lubricants may be acceptable but any grease must be lithium-based, NLGI grade 000. Other types of grease cause damage to mixer seals and **will void your warranty.**

Lubrication Diagram

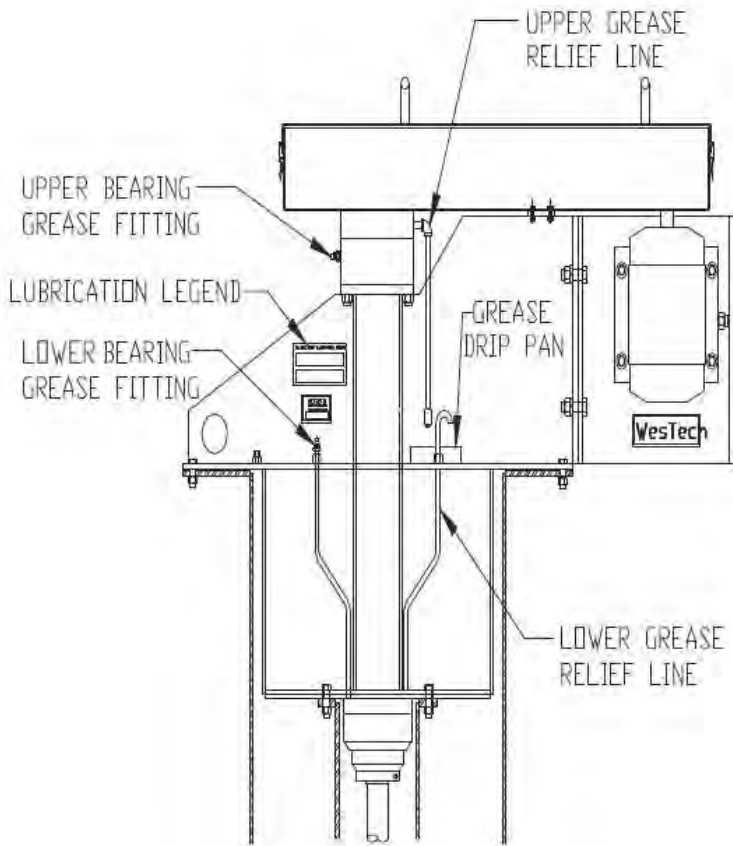


Figure 4.1 Lubrication Diagram

Removal of Mixer Assembly

WesTech Engineering, Inc. recommends removing the mixer for a thorough inspection every five to ten years. To remove the mixer, use the following procedure:

1. The digester produces hazardous gas which is explosive. Therefore, all applicable codes and regulations must be adhered to.
2. **No Smoking.** Workers shall absolutely not smoke in the vicinity.
3. All electric equipment used in the vicinity of the mixer shall be of an explosion-proof type and in compliance with the National Electrical Code for methane hazardous areas.
4. No sparking tools should be used on or around the mixers.
5. Turn the mixer motor power off and secure its disconnect switch to prevent any accidental power return.
6. Detach the motor or disconnect the motor's power wires from the mixer unit. Detaching of the motor will require removal of the belt guard and belt drive.
7. Open ½ inch vent plugs on drive assembly flange and purge mixer housing space to let any entrapped gasses within the mixer well escape. When complete, replace vent plugs so that they are gas tight.
8. Attach a non-sparking, lifting sling to the lifting eyes opposite each other and lift the mixer assembly very carefully and straight up (to avoid sparking or damage to the impeller) with a crane or some other adequate lifting device.

Note: Reinstalling the mixer uses the same procedure as the original installation. Please refer to Section Two entitled "Installation Instructions".

Lower Bearing Inspection

Upon removal and cleaning of the mixer, inspect the lower bearing portion of the mixer for signs of undue wear. Turn the impeller and listen for grinding or scraping noises from the lower housing. Try to move the impeller radially. If any play exists between the lower shaft and bearing housing, the bearing should be replaced. If no play is evident, but the bearing is noisy, lubricate and repeat test.

Removal of Lower Bearing and Seal

1. Pound the roll pin out of the lower impeller nut.

2. Remove the impeller nut.
3. Remove the impeller from the shaft.
4. Remove the flow deflector.
5. Loosen the setscrews on the clampnut and remove the clampnut.
6. Thread the seal housing off the shaft. Inspect the mechanical seal for wear and signs of leakage or damage. Replace if necessary.
7. Unbolt the lower bearing housing. Remove the entire housing and bearing plate from the shaft housing. Inspect the lower bearing for excessive wear, improper lubrication, or other damage. Inspect the lip seal for wear or damage. Remove lip seal and press out the bearing if replacement is necessary.
8. Follow the sludge mixer assembly instructions for re-installation.

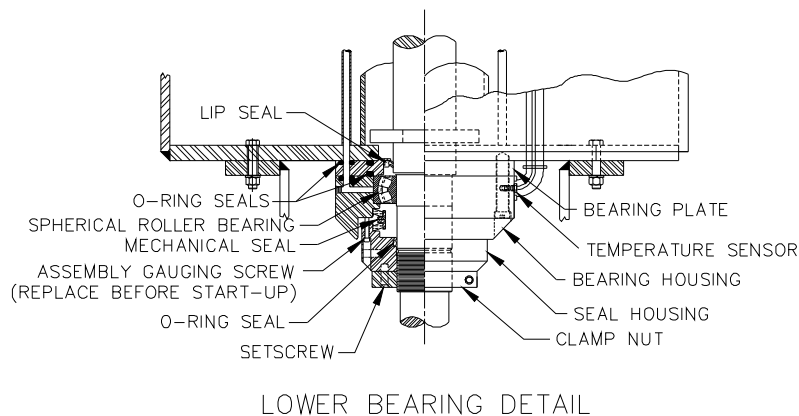


Figure 4.2 Lower Bearing Detail

Upper Bearing Inspection

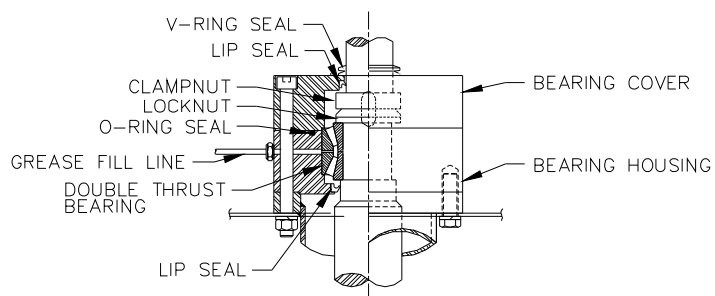
Remove the belt guard cover and remove the belt sheaves from the upper shaft. Remove the belt guard. Unbolt the upper bearing housing cover plate, remove it carefully. Visually inspect the condition of the upper grease seals and the upper bearing. Turn the shaft and observe the upper bearing. Replace the upper bearing if it is excessively worn.

Upper Bearing Removal

The upper bearing is held in place by a clamp nut and locknut. Remove the clamp nut by removing the screw in the side of the nut. Then unthread the clamp nut and the locknut.

The bearing housing can then be removed, bringing the upper bearing and lip seal with it. A wheel puller may be necessary for this operation.

The upper bearing can then be pressed from the housing and replaced.



UPPER BEARING DETAIL

Figure 4.3 Upper Bearing Detail

Sludge Mixer Assembly Instructions

The sludge mixer is shop assembled and shipped as a complete unit. This section gives detailed assembly instructions for initial shop assembly. This is provided herein to aid in maintenance of the sludge mixer.

The following assembly instructions are to be used in conjunction with assembly drawings and parts list #36928.

Assembly of the upper and lower bearings must be done concurrently.

Be sure to use anti-seize lubricant on all stainless steel fasteners.

1. Place the shaft housing (#101) on its side and block it up in a horizontal position.
2. Place the shaft collar (#216) on the impeller shaft (#104 or #473) at the groove location (as shown on drawing 1012 & 1013) and tighten the shaft collar screws.
3. Refer to the diagram below:



Figure 4.4 Flange

Feed the impeller shaft through the upper flange of the shaft housing.

Position the shaft so that the bottom of the shaft collar is $\frac{1}{4}$ " above the lower flange of the Shaft housing.

Beginning with the upper bearing assembly:

4. Place the upper bearing seal (#204) into the upper bearing housing (#120). Apply a light coat of oil on the inside of the upper bearing housing and on the impeller shaft to accept the upper bearing. Place the upper bearing housing with lip seal onto the impeller shaft. Line up the bolt holes. Assure that the grease port is approximately lined up with the grease port on the shaft housing. Temporarily secure the bearing housing to the shaft housing. Secure the bearing

housing to the shaft housing using (4) bolts (#347) and (4) lock washers (#348).

5. Use bearing assembly (#147) to complete the following:

Press the first upper bearing cone onto the impeller shaft (#104 or #473). Press the upper bearing cup into the upper bearing housing.

6. Press the second upper bearing cone onto the impeller shaft (#104 or #473). Thread a locknut (#214) on the shaft hand tight. Final adjustments to be made later.

Moving to the lower bearing assembly:

7. Verify the shaft location (see step 3). The shaft collar should be a maximum of $\frac{1}{4}$ " above the lower flange of the shaft housing. If more than $\frac{1}{4}$ ", the shaft has moved and needs to be re-set. Confirm that the upper bearing is seated (see step 4 and 5). Place the lower lip seal (#205) into the lower bearing plate (#116). Press the lower bearing (#146) into the lower bearing housing (#117).
8. Insert O-rings (#210) and (#211) into the lower bearing plate (#116). Press the lower bearing plate onto the shaft housing flange (#101).
9. Insert O-ring (#211) into the bearing lower housing (#117).
10. Oil the impeller shaft. Press the lower bearing housing (#117) with lower bearing (#146) onto the lower bearing plate (#116). Fasten with (8) bolts (#311).

Return to the upper bearing assembly:

11. Re-tighten the locknut (#214) as tight as possible using a spanner wrench (#235), up to 250 ft. lbs. Rotate the impeller shaft by hand to assure free movement.
12. Place the upper clamp nut (#130) onto the impeller shaft above the locknut (#214). Thread the clamp nut onto the shaft so it is snug against the locknut.
13. Apply Loctite Thread Locker Blue to the 3/8-16 x 1" hex socket head screw (#350) and install it through the clamp nut (#130) and into the keyway of the shaft.
14. Place the O-ring (#209) into the upper bearing housing. Place the upper lip seal (#203) into the upper bearing cover (#121). Slide the upper bearing cover (with lip seal) on the

Note: Loctite has a 60 second cure time. You will need to install immediately after applying the Loctite.

impeller shaft (#104 or #473) and line up the bolt holes. Assure that the grease relief port on the upper bearing cover is approximately lined up with the relief pipe on the shaft housing.

15. Bolt the upper bearing cover and the upper bearing housing to the shaft housing using (4) bolts (#308) and HEX nut with lock washer (#309).
16. Slide the v-ring dust seal (#202) on the impeller shaft so that it touches the top of the bearing cover.

Returning to the lower bearing assembly:

17. Install the mechanical seal (#207) on parts (#117 and #118) as described in the Seal Installation Guidelines (Q017). (See the Accessory Equipment section of this manual).
18. Thread the gauging screw (#150) into the lower seal housing. Do not over tighten. This should stick out of the lower seal housing by the dimension shown on the drawing. To get the screw into the correct position, use a set of dial calipers to achieve dimension shown in detail 2.A Drawing 1013. This is the gap that sets the mechanical seal to the correct compression.

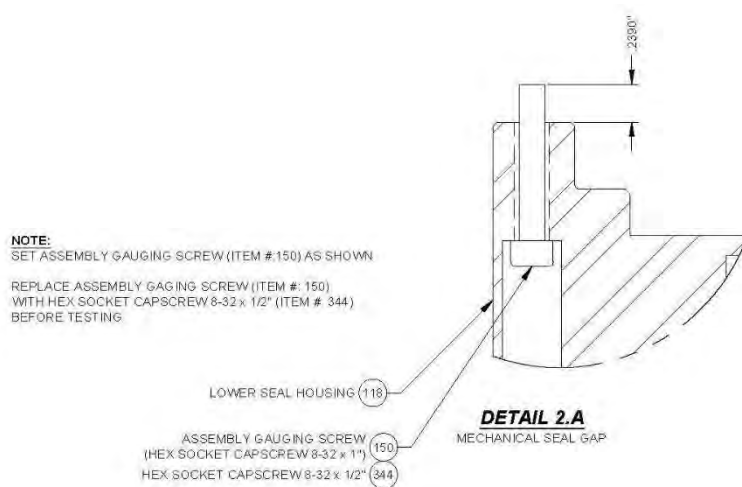


Figure 4.5 Lower Bearing Assembly

19. Place the O-ring (#212) into the groove of the lower seal housing (#118). Place a light coat of oil on the impeller shaft.

20. Place a light coat of oil on the mating faces of the Mechanical seal. Thread the lower seal housing onto the shaft and tighten until the gauging screw (#150) comes into contact with the bearing housing (#117).
21. Thread the clamp nut (#131) onto the shaft until it comes into contact with the lower seal housing (#118). Line up the hole in the clamp nut with the hole in the seal housing. Set screw using (#320).
22. Remove the gauging screw (#150) from the seal housing. Replace it with screw (#344).
23. Thread (2) hex socket plugs (#224) into lower bearing housing.
24. Slide the flow deflector (#110 or #474) over the lower end of the mixer shaft and align the bolt holes to the bolts welded to the shaft housing (#101).
25. Use fasteners (#317) to secure the deflector to the shaft housing (#101)
26. Refer to assembly drawing (1012 & 1013)
27. If grease relief line of the upper bearing was removed during disassembly, install the grease relief line and grease fittings as shown on Detail #1.
28. Apply a light coat of anti-seize lubricant to the impeller shaft (#104 or #473) to accept the impeller.
29. Thread the setscrews (#323) into the bottom of the impeller (#127).
30. Place the keystock (#332) into the keyseat of the impeller shaft (#104 or #473). Slide the impeller (#127) onto the impeller shaft and match up the keyways.
31. Thread the impeller nut (#125) onto the impeller shaft (#104 or #473). Line up the hole in the nut with the hole in the shaft. Tap the roll pin (#326) into the hole.
32. Attach the motor mount, motor, drive, and belt guard as shown on Drawing 1012.

Refer to the Equipment Maintenance section of this manual for the list of approved lubricants.

Note: Verify that the match mark on the flow deflector (#113) aligns with the mark on the shaft housing (#104).

Note: Prior to operating the sludge mixer, grease the upper and lower bearing with #000 grease. Continue to grease the bearings until grease comes out of the relief fittings.

Mixer Troubleshooting

Symptoms	Possible Causes	Detection Method	Possible Solutions
1. Little or no Mixing	A. No power to the Motor	A. Check voltage between three lines at motor	A. Check all breakers and switches
	B. Motor is burned out	B. Remove drive belts from motor and run with no load	B. Replace motor if defective
	C. Broken belt(s)	C. Visual inspection	C. Replace belts
	D. A bearing is Seized	D. With power OFF, try to rotate drive manually	D. Replace top bearing if seized, or remove mixer to replace lower seal and bearing
2. Noisy Mixer	A. Damaged upper bearing	A. Sound Meter on upper bearing housing	A. Replace damaged upper bearing
	B. Damaged lower bearing	B. Metal shavings in return grease line	B. Replace damaged lower bearing
	C. Loose belts	C. Visual inspection	C. Replace damaged belts
3. Mixer is Vibrating	A. Stringy material caught on impeller	A. Vibration Meter, Noise, Visible Shaking	A. Reverse direction of impeller to remove any stringy material.
	B. Imbalanced impeller	B1. Vibration Meter, Noise, Visible Shaking B2. Remove mixer and inspect impeller	B. Replace impeller
4. No grease return from lower bearing	A. Plugged or frozen grease line.	A. Visual inspection	A. Insert fish tape to unplug grease line
	B. Seal failure	B. Grease and verify grease return	B. Replace seal

Figure 4.6 Mixer Troubleshooting

Motor Troubleshooting

Symptoms	Possible Causes	Result	Possible Solutions
1. Motor Does Not Start	A. Incorrectly connected	A. Burnout	A. Connect correctly per diagram on motor
	B. Incorrect power supply	B. Burnout	B. Use only with correct rated Power supply.
	C. Fuse blown, loose or open connection	C. Burnout	C. Correct open circuit condition
	D. Open control circuit	D. None	D. Correct open circuit connection
	E. Rotating parts of motor may be jammed mechanically	E. Burnout	E. Check and correct: 1. Bent shaft 2. Broken housing 3. Damaged bearing 4. Foreign material in motor
	F. Driven machine may be jammed	F. Burnout	F. Correct jammed condition.
	G. No power supply	G. None	G. Check for voltage at motor and work back to power supply
2. Motor starts but does not come up to speed.	A. Same as 1-A,B,C Above	A. Same as 1-A,B,C Above	A. Same as 1-A,B,C Above
	B. Overload	B. Burnout	B. Reduce load to bring current to rated limit. Use proper fuses and overload protection.
3. Motor Noisy Electrically	A. Same as 1-A,B,C Above	A. Same as 1-A,B,C Above	A. Same as 1-A,B,C Above
4. Motor runs hot (exceeds rating)	A. Same as 1-A,B,C Above	A. Same as 1-A,B,C Above	A. Same as 1-A,B,C Above
	B. Overload	B. Burnout	B. Reduce Load
	C. Impaired Ventilation	C. Burnout	C. Remove Obstruction
	D. Frequent Start or Stop	D. Burnout	D. 1. Reduce number of starts or reversals 2. Secure proper motor for this duty
	E. Burnout	E. Realign	E. Misalignment between rotor and stator laminations

Motor Troubleshooting Continued

Symptoms	Cause	Result	Remedy
5. Noisy Mechanically	A. Misalignment of coupling or sprocket	A. Bearing failure, broken shaft, stator burnout due to motor drag	A. Correct Misalignment
	B. Mechanical unbalance of rotating parts	B. Same as 5-A	B. Find unbalanced part, then balance
	C. Lack of or improper lubricant	C. Bearing failure	C. Use correct lubricant, replace parts as necessary
	D. Foreign material in lubricant	D. Same as 5-C	D. Clean out and replace bearings
	E. Overload	E. Same as 5-C	E. Remove overload condition, Replace damaged parts
	F. Shock Loading	F. Same as 5-C	F. Correct causes and replace damaged parts
	G. Mounting acts as amplifier of normal noise	G. Annoying	G. Isolate motor from base
	H. Rotor dragging due to worn bearings, shaft, or bracket	H. Burnout	H. Replace bearings, shaft, or bracket as needed
6. Bearing Failure	A. Same as 5-A, B, C, D	A. Burnout, Damaged Shaft, Damaged Housing	A. Replace Bearings and follow 5-A, B, C, D, E
	B. Entry of water or foreign material into bearing housing	B. Same as 6-A	B. Replace Bearings and shield against entry of foreign material (water, dust, etc.) – use proper motor

Figure 4.7 Motor Troubleshooting

Shutdown and Storage

Generally speaking, it is preferable to store mechanical and electrical items indoors in a dry, well ventilated enclosure with a constant as possible temperature. The equipment should be adequately supported to prevent distortion and undue stresses. It should be at least six inches off the floor.

Whether stored indoors or outdoors, the steps outlined in the following should be taken:

“Short Term” is from 30 to 120 days,

“Long Term” is 120 days or more.

1. Short Term Storage or Shutdown

The following instructions also apply if there is to be a period of time between installation and start-up or between start-up and the equipment going into service. These steps are required to protect against corrosion and assure proper operating conditions.

Cover equipment with a tarpaulin that allows adequate ventilation, drainage, and inspection access in an area protected against wind, direct sunlight, rain, and snow.

Space heaters should be used in cold or wet weather.

Coat all unpainted metal surfaces with oil.

At least once a month, relubricate all items that are grease lubricated and grease exterior surfaces of all seals. Inspect all of the equipment for signs of corrosion and take corrective steps as required.

If power is connected, operate the equipment for five minutes approximately once a week to prevent brinelling of bearings, and to maintain lubricant condition and pliability of seals. If power is

not connected, the equipment should be manually rotated enough to accomplish the above.

In addition to these steps, the instruction manuals of the manufacturers of the speed reducers, variable speed drives, etc. should be read and their instructions followed.

2. Long Term Storage or Shutdown

In addition to those steps shown under “Short Term”, the following steps should be taken whether storage is indoors or outdoors:

Periodic checks, frequency dependent upon ambient conditions, must be made of painted surfaces for deterioration of paint. Wide variations in ambient temperatures are conducive to condensation with its resultant oxidation. Steps should be taken to protect the affected surfaces. Bitumastic coatings tend to become brittle and to chip. Increasing ventilation and reducing humidity are frequently required. Where equipment is well covered and protected-inspection doors, covers, etc. should be blocked open slightly to increase ventilation. Relatively small areas and shafts can be coated with a waterproof grease or rust inhibitor.

3. Speed Reducer, Gear Drive, Etc.

The respective manufacturer's instruction manuals should be followed closely. At the very least, the following steps should be taken in addition to the steps called for under "Short Term".

Units that were furnished with a dry sump should be filled completely with oil, if they are the oil lubricated type.

Any breathers, vents, etc. should be taped over.

Disconnect hanging loads or block support to relieve the load on bearings.

Re-grease those units that are grease lubricated.

Tag the unit to indicate what must be done before starting up, such as:

- A. Drain oil to operating level
- B. Remove tape from vents and from breathers
- C. Re-grease
- D. Re-connect hanging loads or remove blocking

4. Electric Motors

The following are considered by motor manufacturers to be the minimum precautions for outdoor storage of electric motors:

1. Coat all machined parts with Cosmoline or similar material, if not already protected. Motors should be elevated a minimum of six inches above the ground.
2. Remove plastic covering (or carton) and cover motors with a tarpaulin. This will offer protection from the weather while allowing the motor to breathe.

3. Keep the motors warm. If equipped with a space heater, energize at all times. If space heaters were not supplied, auxiliary heat must be used to keep the motor windings warm and free of condensation.
4. Motors with grease lubricated bearings have inherent rust inhibitors in the grease. The shaft should be rotated slowly by hand at least once every 30 days. This will distribute the grease in the bearings.
5. All drains should be fully operable while in storage, and/or the drain plugs removed. The motors must be stored so that the drain is at the lowest point. All breathers and automatic "T" drains must be operable to allow breathing. Vertical motors should be stored in the vertical position.
6. All units equipped with heaters are to have the heaters connected, if storage conditions in any way simulate or approach atmospheric conditions experienced in operation.
7. Windings to be megged at the time equipment is put into storage. At termination of storage, the motor should be megged prior to applying power. The minimum reading should be 1 megohm for motors rated 600 volts and less; 3 megohms for 2300 volt motors. Any drop below this point necessitates electrical or mechanical drying. Where large quantities of motors are stored, an inspection or sampling should be made by removing the end brackets and visually inspecting the motors for the presence of water in the grease or rust on the bearing. If present, replace the bearings and lubricate.
8. Grease in the motors to be purged at the time of removal from storage, making sure that an ample supply of fresh grease is in each grease cavity.
9. All external parts and motors subjected to corrosion should be protected by some corrosive resistant coating.
10. Where motors are not installed in the original containers, but are removed and mounted on other pieces of machinery, the mounting must be such that the drains and breathers are fully operable. In this respect, the drains must be kept at the lowest point in the motor and/or the drain plugs removed so that all condensation can automatically drain out. Vertical motors should be stored in the vertical position.

All other storage conditions apply, including rotation of motor shafts.

Explanation of Parts List

Item Numbers

Item numbers identify a part shown on an erection or assembly drawing. Item numbers are in circles on the drawing with an arrow pointing to the part. On the parts list, item numbers are found in the left most column of the list. Item numbers are three digit numbers.

Location of Parts Lists

Electrical Parts List is included with Section Six: Electrical

Equipment Parts List is included with Section Seven: Enclosures.

Parts List Item Numbers				Parts List Part Number						
Item No.	Qty / Assy	Qty / Order	Units	Part Number	Drawing Number	Dwg Rev	Description of Parts	Material	Weight per Item	Line Rev
101							SLUDE MIXER ASSEMBLY:			
102										
103										
104	1	2	EACH	1020A	1020-1,2	0	SHAFT HOUSING	STL	957	0
105	1	2	EACH	1021A	1021	0	MOTOR MOUNT-FOR FRAME 182T	STL	108	0
106										
107	1	2	EACH	1022A	1022	0	IMPELLER SHAFT 24" DIA.	CRS	456	0
108										
109	1	2	EACH	1023A	1023	0	BELT GUARD	304	94	0
110	1	2	EACH	1024A	1024	0	BELT GUARD COVER	304	45	0
111										
112										
113	1	2	EACH	1025A	1025	0	FLOW DEFLECTOR	STL	194	0
114	1	2	EACH	SMXDT085	SMXDT085	0	WEAR SLEEVE	STL	1	0
115										
116	1	2	EACH	SMXDT086A	SMXDT086A	A	LOWER BEARING PLATE	STL	16	0
117	1	2	EACH	SMXDT082A	SMXDT082A	F	LOWER BEARING HOUSING	STL	38	0
118	1	2	EACH	SMXDT083A	SMXDT083A	B	LOWER SEAL HOUSING	STL	12	0
119										
120	1	2	EACH	SMXDT079A	SMXDT079A	A	UPPER BEARING HOUSING	STL	39	0
121	1	2	EACH	SMXDT080A	SMXDT080A	C	UPPER BEARING COVER	STL	41	0
122										
123	1	2	EACH	SMXDT073A	SMXDT073A	A	LUBRICATION LEGEND	ACRYLIC		0
124										

Figure 4.8 Example Parts List

Procedure for Ordering Spare or Replacement Parts

Spare or replacement parts may be ordered from the Aftermarket Sales Department at:

WesTech Engineering, Inc.
3665 South West Temple
Salt Lake City, Utah 84115
Phone: (801) 265-1000
Fax: (801) 265-1080
24-hour service/emergency: (801) 265-1000
Email: parts@westech-inc.com
Web: www.westech-inc.com

If you would like to talk directly to an Aftermarket Sales representative during normal business hours (8:00 am to 4:30 pm MST), dial (801) 265-1000 and ask for the Aftermarket Sales Department. You may fax your order to (801) 265-1080.

To use the 24-hour service/emergency line after hours (4:30 pm to 8:00 am), dial (801) 265-1000. **Please indicate to the Answering Service Operator whether your facility is Water, Waste Water or Industrial.** They will inform you that a WesTech Representative will call and assist you with your problem.

If you would like to e-mail a spare parts order, simply e-mail your request to us at parts@westech-inc.com and a WesTech representative will process your order and follow up with an Order Acknowledgment.

Spare parts may also be requested directly from our web page www.westech-inc.com. Simply go to the web page, click on Parts and Service. If you know the part number and job information you need, you can input it directly. A WesTech Representative will process your request and follow up with a purchase quotation, or a return phone call to confirm that your request has been received.

For convenience, a 'Recommended Spare Parts List' is provided in this manual. This is a guide for the appropriate level of spares to keep on hand minimizing lost time due to unscheduled breakdowns. Each item listed in the Recommended Spare Parts List is identified within one of the following categories:

- Normal maintenance and wear items.
- Long Lead items (minimum downtime).

Should you require further assistance in determining which spare parts are appropriate for your particular situation please contact WesTech's Aftermarket Sales Department.

To avoid unnecessary delays in obtaining the correct spare or replacement parts for your equipment, be sure to give the following information with each order.

1. Identify equipment using the WesTech Job number. Your equipment is identified as follows:

WesTech Job Number: 22397A

WesTech Model Number: SME1

2. Identify the part by name and give the number of the drawing on which this part or assembly appears.
3. Identify the part number.
4. Identify the size and include all pertinent dimensions (such as diameter, length, thickness, bore, pitch, etc.) whenever possible.
5. If parts being ordered are electrical in nature, give all pertinent data such as voltage, amperage, wattage, cycles, speed, power factor, or other information given on the parts nameplate or included in the parts brochure.
6. Submit your written purchase order or request for a quotation, both signing and printing your full name so that WesTech will know whom to contact should further clarification of the inquiry be necessary. **All verbal orders must be verified in writing.**
7. Give a return address and a shipping address.
8. Give a preferred method of shipping: i.e., UPS, truck freight, rail freight, air express, etc.
9. Indicate the quantity desired.
10. Provide instructions for proper invoicing.

All spare or repair parts orders are subject to a \$100.00 minimum order charge.

24 Hour Emergency: (801) 265-1000

To use the 24-hour service line, dial the above number and give the representative your name, phone number and a short explanation of what is wrong. This information will then be forwarded to the right person who will then respond to you within one hour.

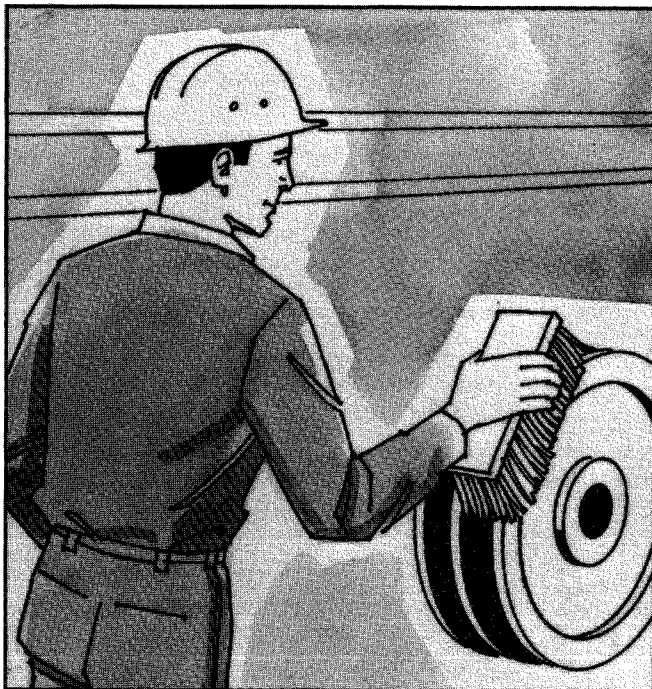
Installation

Torque-Flex®, Hy-T®, Hy-T Wedge®, Torque Team®, Hex, and FHP V-Belts

1. INSPECT SHEAVES

WARNING

Do not clean sheaves while the machine is running. Disconnect power supply to the machine before removing or installing sheaves. Take sheaves off machines to inspect, clean and repair them.

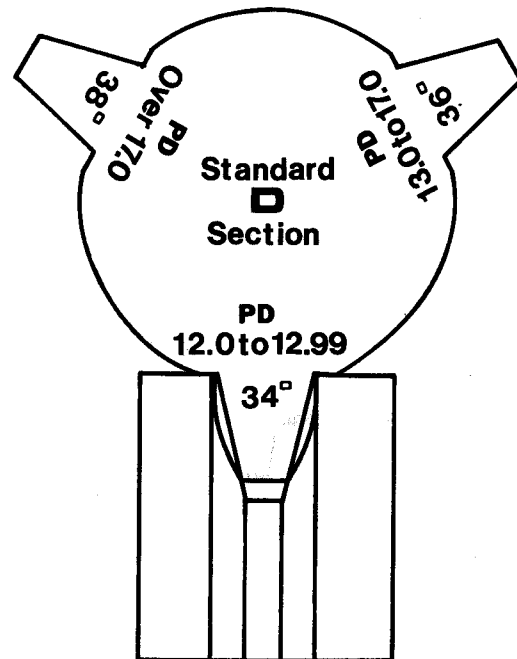


Damaged, worn or dirty sheaves will substantially reduce belt life. Nicks or gouges can cut the belt. Dirt in the grooves can abrade the belt and oil can attack the belt materials. Worn grooves will allow the belt to bottom out, slip and become damaged.

Use a stiff brush to clean off rust and dirt. Wipe clean of oil and grease.

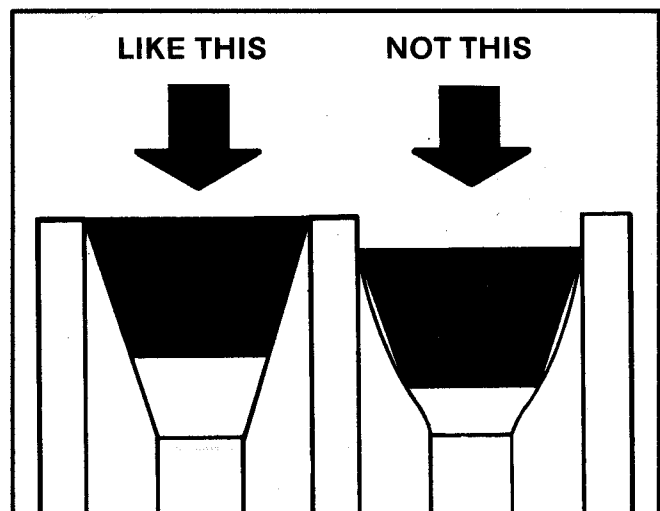
CAUTION

Do not reinstall damaged or worn sheaves on equipment. Repair or replace them.



Sheave Groove Gauge

Select the proper sheave groove gauge and template for the sheave diameter. Insert the gauge in the groove and look for voids which indicate *dishing* or other uneven and abnormal wear.

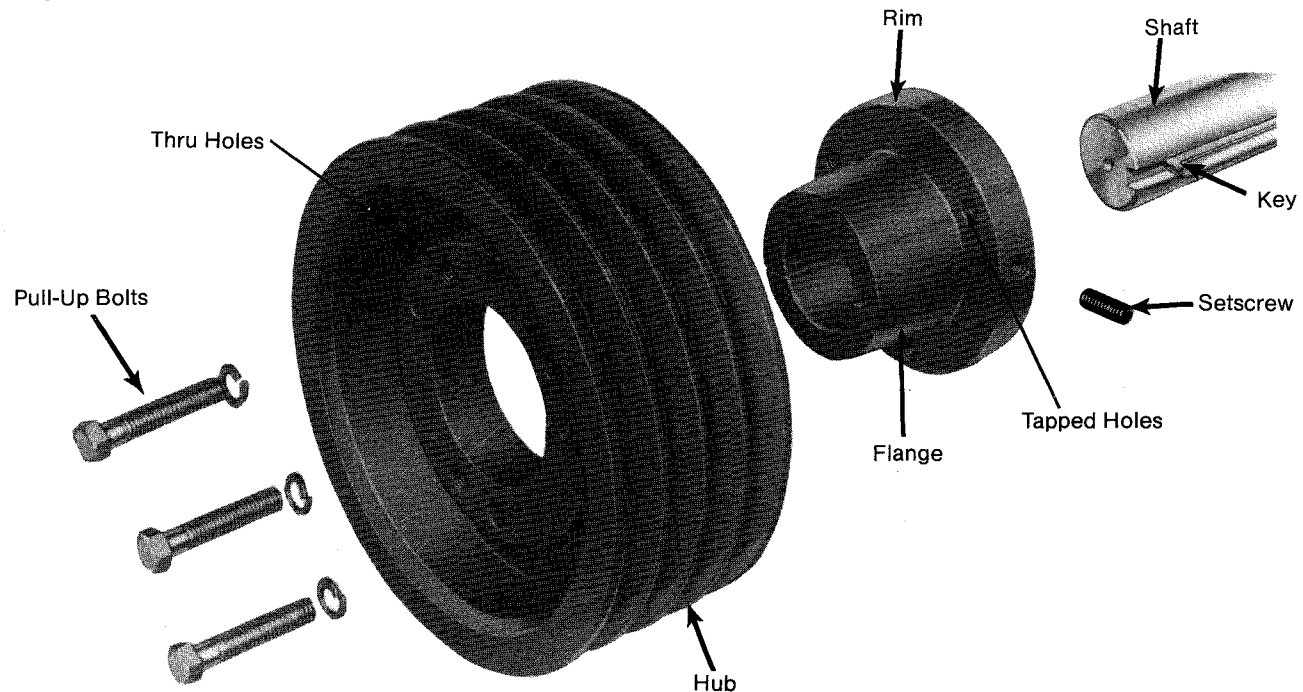


Place a new belt in the sheave groove. The top of the belt should be flush with the outer diameter of the sheave. If the belt top is below the outer diameter of the sheave, the groove is worn.

2. MOUNT SHEAVES

THE QD® HUB (Conventional Mount)

HOW TO MOUNT THE QD® HUB



* QD IS A REGISTERED TRADEMARK OF EATON CORP.

WARNING

Disconnect power supply to the machine before removing or installing sheaves.

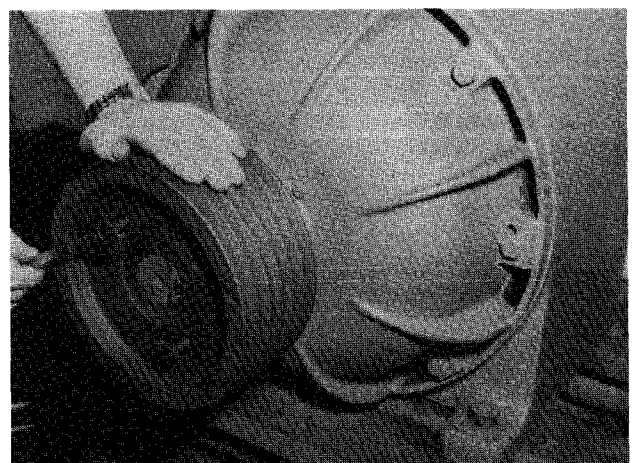
Insert the hub in the rim and line up bolt holes. Insert the pull-up bolts and turn until finger tight.

Hold the loosely assembled unit so the hub flange is toward the shaft bearings. Slip the unit onto the shaft and align the rim in the desired position. See *Step 3, Page 10*, for alignment details.

Tighten the setscrew in the flange only enough to hold the assembly in position.

Tighten each pull-up bolt alternately and evenly.

Recheck alignment and completely tighten the setscrew onto the shaft.



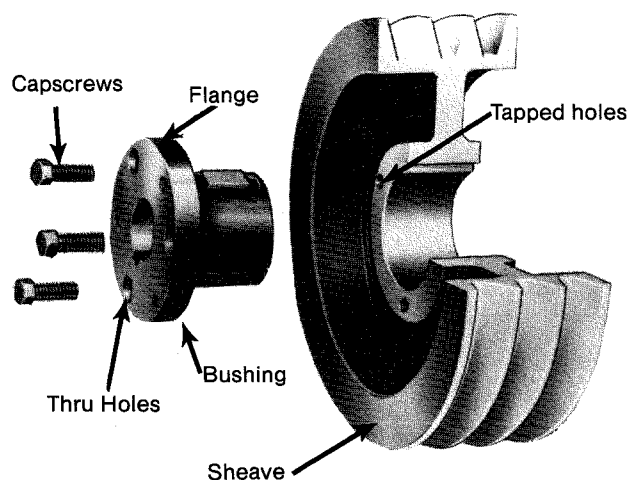
HOW TO REMOVE THE QD® HUB

Place two of the pull-up bolts in the tapped holes in the sheave. Turn the bolts alternately and evenly. They will push against the hub flange and act as jackscrews to break the grip between the hub and the rim.

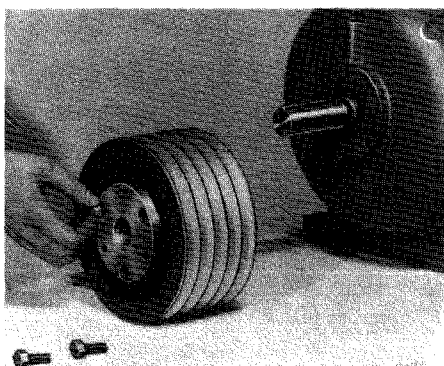
B. THE SPLIT TAPER BUSHING

WARNING

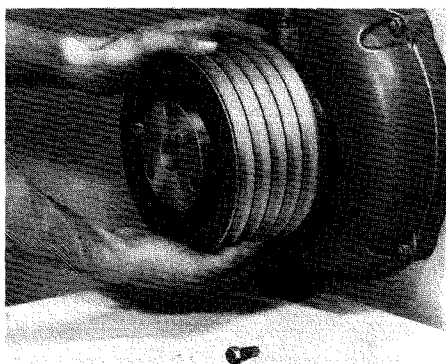
Disconnect power supply to the machine before removing or installing sheaves.



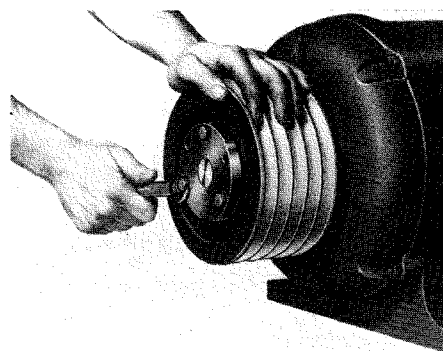
HOW TO MOUNT SPLIT TAPER BUSHING SHEAVES



Put the bushing loosely in the sheave and start the cap screws.



Place the assembly on the shaft. Align both edges of the sheave with the edges of its mating sheave (i.e. the sheave on the driven shaft). See *Step 3*, page 10, for details.

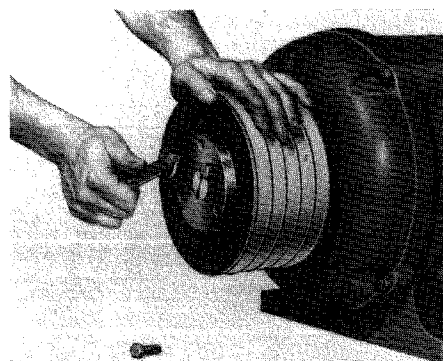


Tighten the cap screws according to the instructions furnished with the bushing.

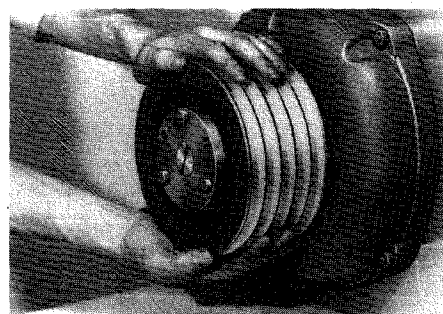
HOW TO REMOVE SPLIT TAPER BEARING SHEAVES



Remove all cap screws.



Put two of the cap screws in the tapped holes in the flange of the bushing. Turn the bolts alternately and evenly until the sheave has loosened.



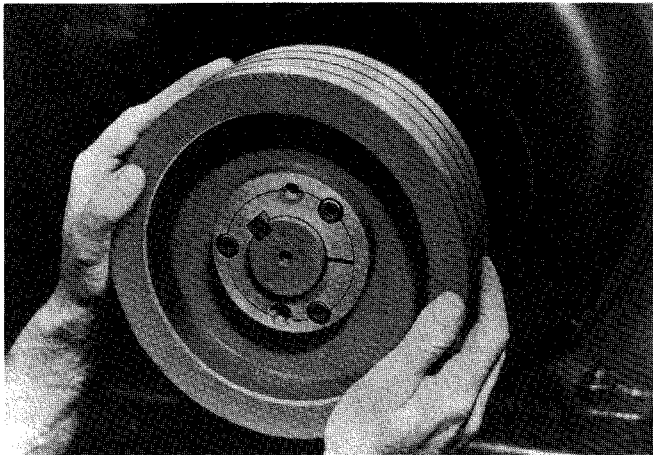
Remove the sheave/flange assembly from the shaft.

WARNING

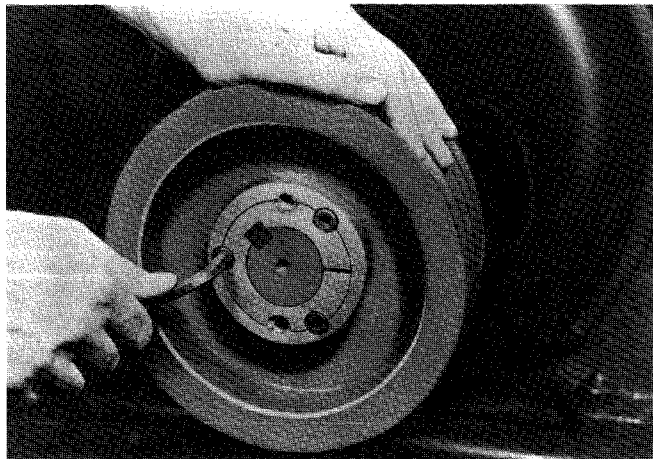
Disconnect power supply to the machine before removing or installing sheaves.

C. THE TAPER-LOCK® BUSHING

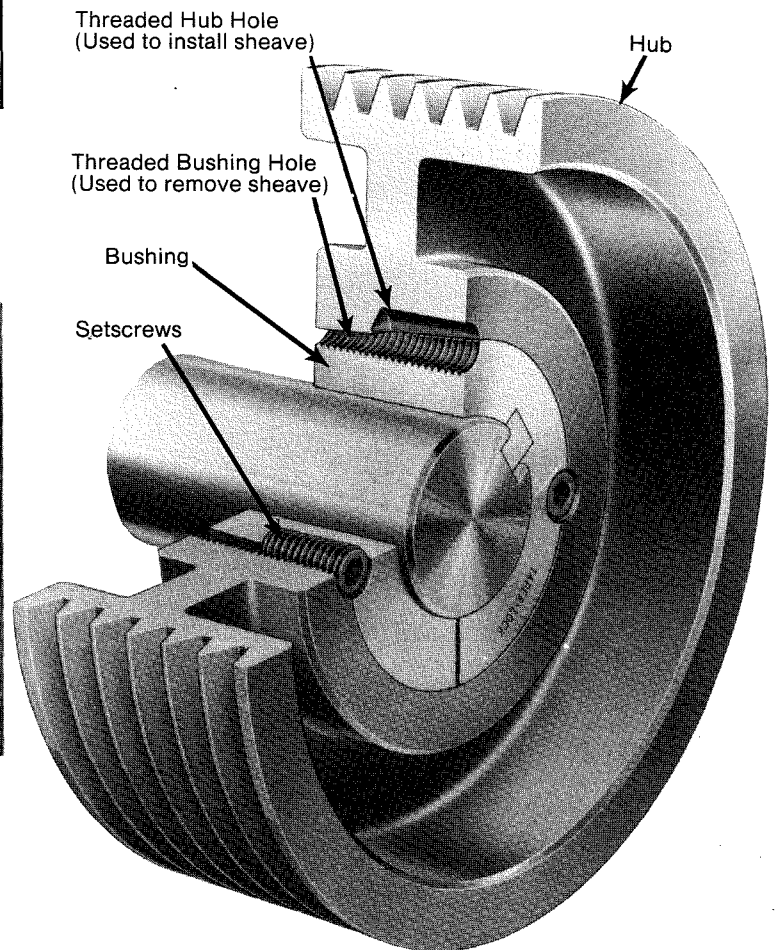
HOW TO MOUNT THE TAPER-LOCK BUSHING



Look at the bushing and the hub. Each has a set of half-holes. The threaded holes in the hub are the mates to the non-threaded holes in the bushing. Insert the bushing in the hub and slide it onto the shaft. Align the holes (*not the threads*). Start the setscrews into the holes that are threaded in the hub only. Do not tighten the setscrews yet.



Align both edges of the sheave with the edges of its mating sheave. See *Step 3*, page 10 for details. Tighten the screws alternately and evenly. This will wedge the bushing inward and cause it to contract evenly and grip the shaft.



Taper-Lock: TM Reliance Electric Company

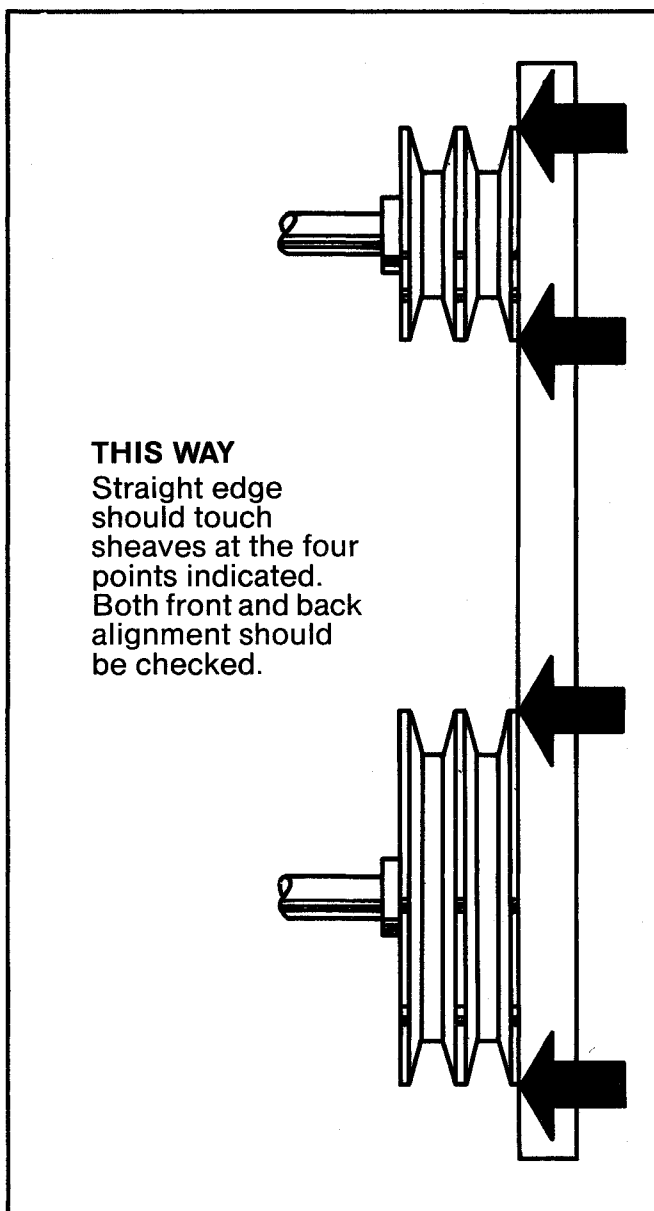
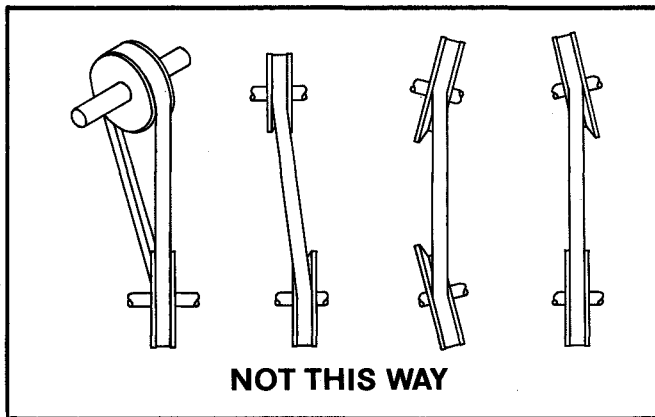
HOW TO REMOVE THE TAPER-LOCK BUSHING



Remove all the setscrews. Place two of the setscrews in the holes that are threaded in the bushing only. Turn the setscrews alternately and evenly. This will unlock the grip and permit easy removal of the assembly with no shock to the bearings or machinery.

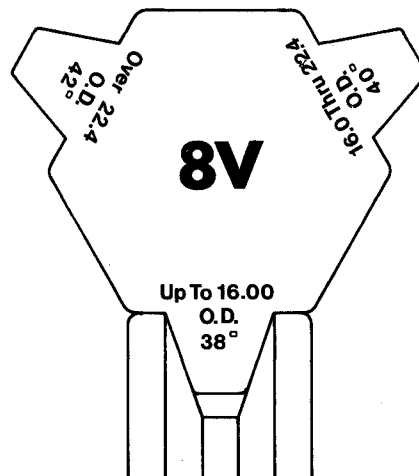
3. CHECK ALIGNMENT

Proper alignment is essential to maintain long V-belt life. Belt alignment should be checked every time belt maintenance is performed, each time belts are replaced, and whenever sheaves are removed or installed.

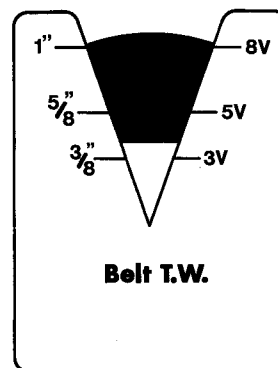


4. SELECT THE CORRECT BELT

Always select belts to match sheave grooves. Use a sheave groove gauge to determine the proper belt cross section. Use a belt gauge to verify the old belt cross-section used when belt identification is no longer legible.



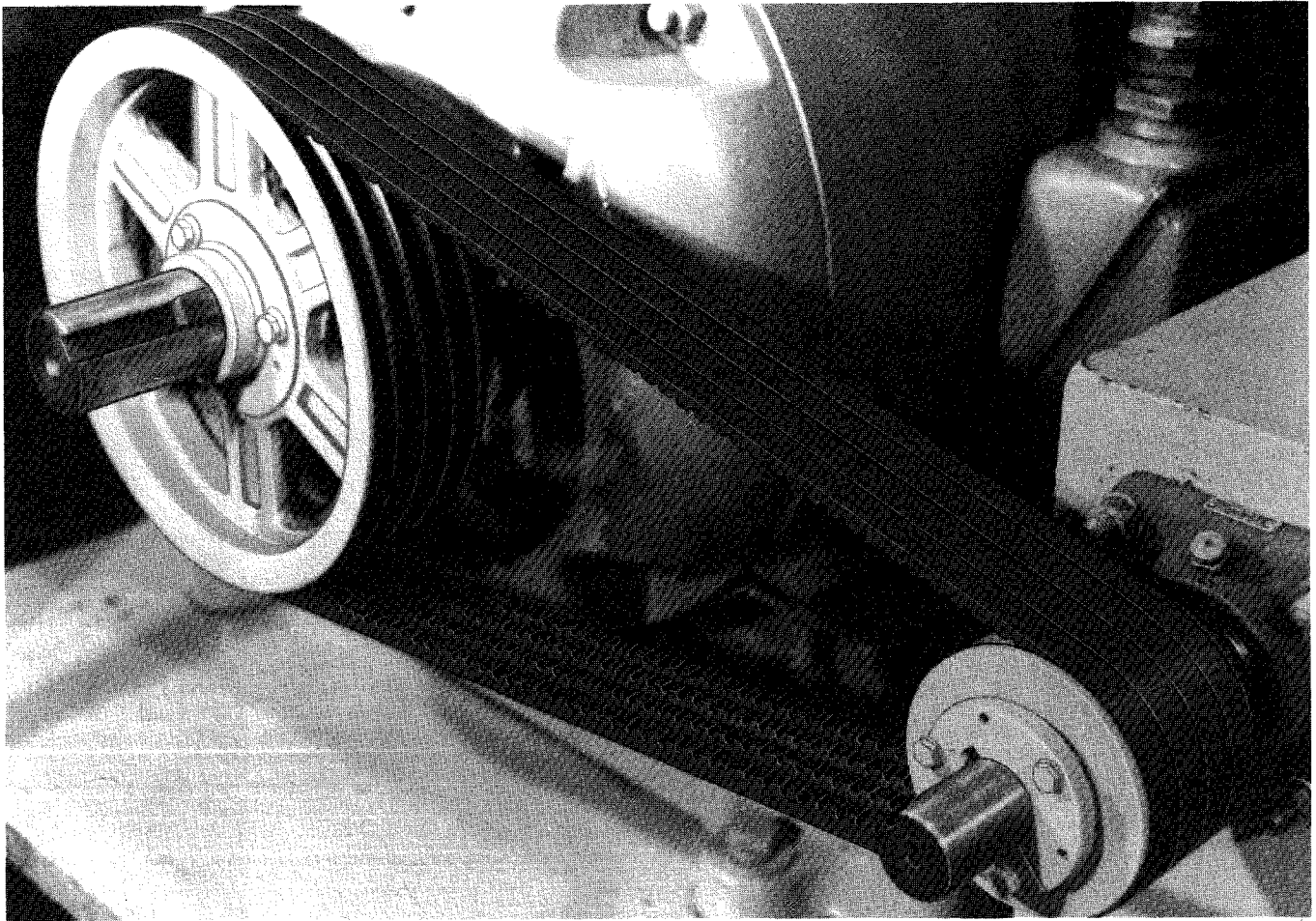
Sheave Groove Gauge



Belt Gauge

If the drive requires "A," "B," "C" or "D" section belts, select the Hy-T or premium Torque-Flex (not available in "D") belt recommended for your application. If you have experienced short belt life with standard belts, a higher grade of belt will increase service life.

5. MATCH THE BELTS



WARNING

Do not test or operate belt drives without guards in place.

All Goodyear V-belts are manufactured under rigid quality control procedures so that all belts produced in a given size may be matched with each other. It is not necessary to use matching code numbers and such numbers no longer appear on the belts.

The following procedures should be followed whenever a new set of belts is installed.

DON'T MIX BELT BRANDS

Each brand of V-belt has different performance characteristics. Drives will not deliver the power or service expected when a mix of belt brands is used.

DON'T MIX NEW AND USED BELTS

Always replace complete sets of V-belts with new V-belts, even if only one or two seem worn or damaged.

Do not attempt to assemble two or more used V-belts for a set. They will not perform as expected.

Reusing V-belts where matched sets are required will substantially reduce the life of the drive.

NOTE: TorqueTeam belts (joined belts) provide the benefits of the joined principal as well as a wider team. A matched set of a two-belt and a three belt TorqueTeam will provide service equal to five single belts in a team. Sheave wear is very important to long life for any V-belt, but critical for TorqueTeam belt applications. Worn sheaves will destroy joined belts very quickly.

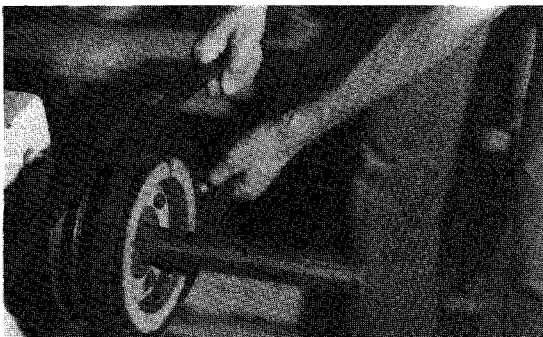
6. HOW TO INSTALL BELTS

WARNING

Disconnect power supply to the machine before removing or installing sheaves or belts.



WRONG — Never force the belts into a sheave with a screwdriver or wedge. You will rupture the envelope fabric and break the cords.



Always move the drive unit forward so the belts can be easily slipped into the grooves without forcing them.

CENTER DISTANCE ALLOWANCE FOR BELT INSTALLATION AND TAKE-UP.

Tables 3 and 4 show the minimum movement below and above the standard center distance which is required between the sheaves. This movement allows the center distance to be shortened for new belt installation. It also allows the center distance to be increased to take up slack and maintain proper tension as the belt stretches. See *Step 7* for additional information on belt tensioning.

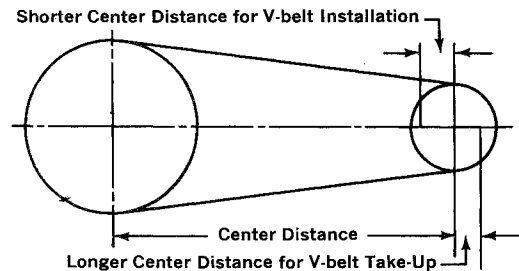


TABLE 3

Standard Length Designation	Minimum Allowance Below Standard Center Distance for Installation of Belts								Minimum Allowance Above Standard Center Distance for Maintaining Tension All Cross Sections
	A	B	B Torque Team	C	C Torque Team	D	D Torque Team	E	
Up to and Incl. 35	0.75	1.00	1.50						1.00
Over 35 to and Incl. 55	0.75	1.00	1.50	1.50	2.00				1.50
Over 55 to and Incl. 85	0.75	1.25	1.60	1.50	2.00				2.00
Over 85 to and Incl. 112	1.00	1.25	1.60	1.50	2.00				2.50
Over 112 to and Incl. 144	1.00	1.25	1.80	1.50	2.10	2.00	2.90		3.00
Over 144 to and Incl. 180		1.25	1.80	2.00	2.20	2.00	3.00	2.50	3.50
Over 180 to and Incl. 210		1.50	1.90	2.00	2.30	2.00	3.20	2.50	4.00
Over 210 to and Incl. 240		1.50	2.00	2.00	2.50	2.50	3.20	2.50	4.50
Over 240 to and Incl. 300		1.50	2.20	2.00	2.50	2.50	3.50	3.00	5.00
Over 300 to and Incl. 390				2.00	2.70	2.50	3.60	3.00	6.00
Over 390				2.50	2.90	3.00	4.10	3.50	1.5% of belt length

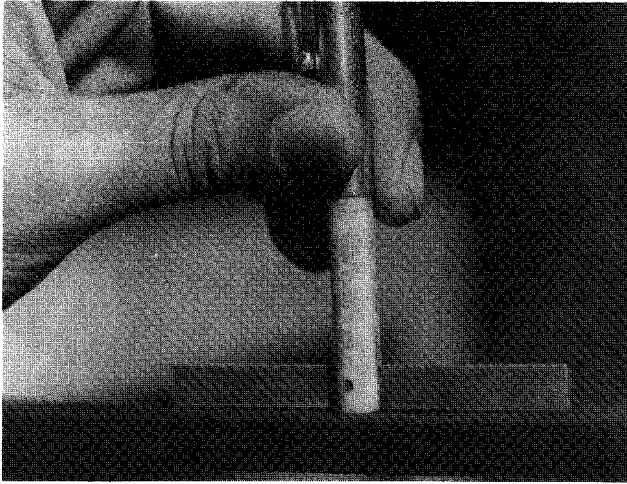
TABLE 4 — Hy-T Wedge V-belts

Standard Length Designation	Minimum Allowance Below Standard Center Distance for Installation Of Belts, Inches						Minimum Allowance Above Standard Center Distance for Maintaining Tension, Inches All Cross Sections
	3V	3V Torque Team	5V	5V Torque Team	8V	8V Torque Team	
Up to and Incl. 475	0.5	1.2					1.0
Over 475 to and Incl. 710	0.8	1.4	1.0	2.1			1.2
Over 710 to and Incl. 1060	0.8	1.4	1.0	2.1	1.5	3.4	1.5
Over 1060 to and Incl. 1250	0.8	1.4	1.0	2.1	1.5	3.4	1.8
Over 1250 to and Incl. 1700	0.8	1.4	1.0	2.1	1.5	3.4	2.2
Over 1700 to and Incl. 2000			1.0	2.1	1.8	3.6	2.5
Over 2000 to and Incl. 2360			1.2	2.4	1.8	3.6	3.0
Over 2360 to and Incl. 2650			1.2	2.4	1.8	3.6	3.2
Over 2650 to and Incl. 3000			1.2	2.4	1.8	3.6	3.5
Over 3000 to and Incl. 3550			1.2	2.4	2.0	4.0	4.0
Over 3550 to and Incl. 3750					2.0	4.0	4.5
Over 3750 to and Incl. 5000					2.0	4.0	5.5

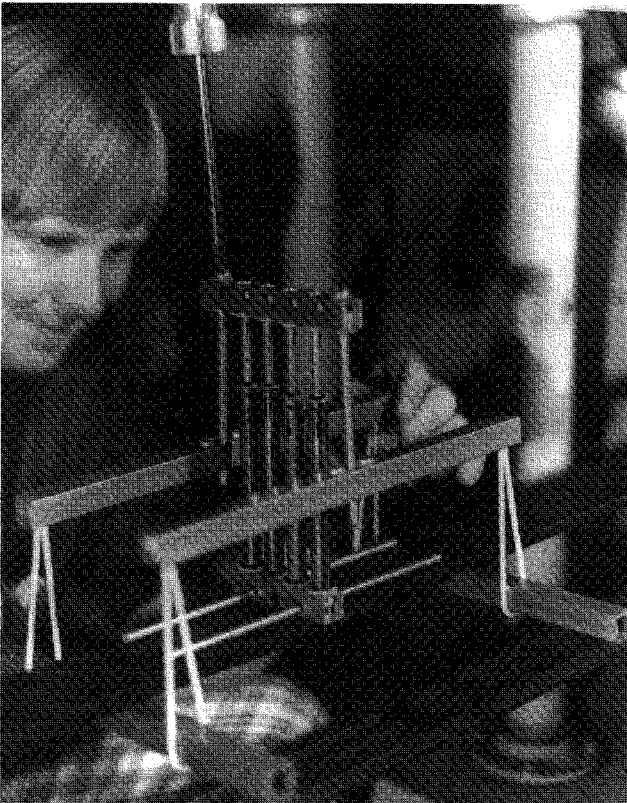
7. HOW TO TENSION THE BELTS

WARNING

Disconnect power supply to the machine before removing, installing or adjusting belts.



A Tension tester is used to check V-belt tension values.

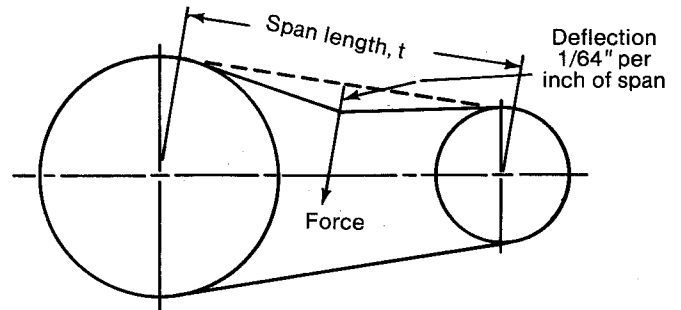


A multiple gauge tensioning device should be used to establish tension values on Torque Team belts.

COMMON SENSE RULES OF V-BELT TENSIONING

- The ideal tension is the lowest tension at which the belt will not slip under peak load conditions.
- Check the belt tension frequently during the first 24-48 hours of run-in operation.
- Do not over tension belts. This shortens belt and bearing life.
- Keep belts free from foreign material which may cause slippage.
- Inspect the V-drive periodically. Retension the belts if they are slipping.
- Maintain sheave alignment with a strong straight-edge tool while tensioning V-belts.

HOW TO CHECK THE TENSION IN A CONVENTIONAL V-BELT DRIVE

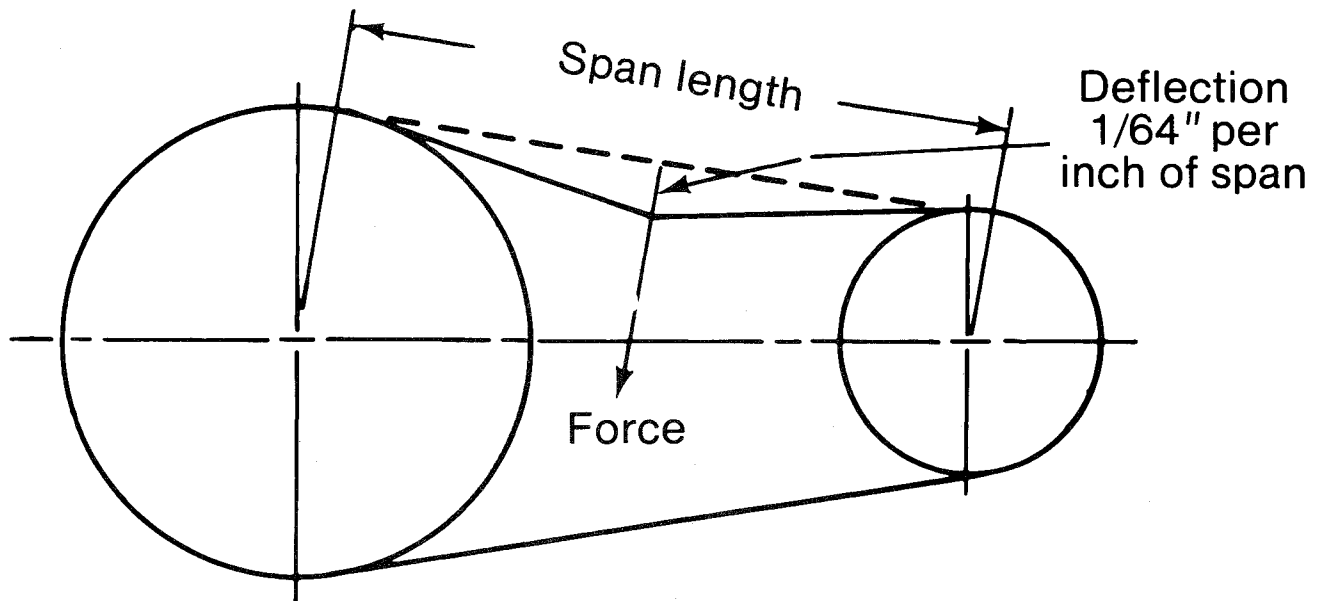


1. Measure the span length, t . (See illustration)
2. Mark the center of span t . At the center mark, use a tension tester and apply a force perpendicular to the span large enough to deflect the belt $1/64"$ for every inch of span length. (Ex: a 100" span requires a deflection of $100/64"$ or $1\ 9/16"$)
3. Compare the force applied with the values in Tables 5 and 6 on the next page. A force between the value shown and 1.5 times (1.5X) the value shown should be satisfactory. A force below the tension value indicates an undertensioned drive and may result in slippage. A force above the tension value indicates an overtensioned drive and may result in belt and drive damage.

NOTE: A drive with newly installed belts can be tightened initially to two times (2X) the normal tension to allow for the drop in tension which will occur during run-in.

TABLE 5 – BELT DEFLECTION FORCE

The values below are based on operating speeds of 1000 – 3000 feet per minute. For belt speeds in excess of 3000 feet per minute, reduce the deflection force by 20%. Check the factory for operating speeds less than 1000 feet per minute and for other conditions not covered in the tables.

**TABLE 5 – BELT DEFLECTION FORCE**

Cross Section	Smallest Sheave Diameter Range	RPM Range	Belt Deflection (Force Pounds)			
			Uncogged Hy-T Belts and Uncogged Hy-T Torque Team		Cogged Torque-Flex and Machined Edge Torque Team Belts	
			Used Belt	New Belt	Used Belt	New Belt
A, AX	3.0- 3.6	1000-2500 2501-4000	3.7 2.8	5.5 4.2	4.1 3.4	6.1 5.0
	3.8- 4.8	1000-2500 2501-4000	4.5 3.8	6.8 5.7	5.0 4.3	7.4 6.4
	5.0- 7.0	1000-2500 2501-4000	5.4 4.7	8.0 7.0	5.7 5.1	9.4 7.6
B, BX	3.4- 4.2	860-2500 2501-4000			4.9 4.2	7.2 6.2
	4.4- 5.6	860-2500 2501-4000	5.3 4.5	7.9 6.7	7.1 7.1	10.5 9.1
	5.8- 8.6	860-2500 2501-4000	6.3 6.0	9.4 8.9	8.5 7.3	12.6 10.9
C, CX	7.0- 9.0	500-1740 1741-3000	11.5 9.4	17.0 13.8	14.7 11.9	21.8 17.5
	9.5-16.0	500-1740 1741-3000	14.1 12.5	21.0 18.5	15.9 14.6	23.5 21.6
D	12.0-16.0	200- 850 851-1500	24.9 21.2	37.0 31.3		
	18.0-20.0	200- 850 851-1500	30.4 25.6	45.2 38.0		

TABLE 6

Cross Section	Smallest Sheave Diameter Range	RPM Range	Belt Deflection (Force Pounds)			
			Uncogged Hy-T Wedge Belts and Uncogged Hy-T Wedge Torque Team		Cogged Hy-T Wedge Belts and Hy-T Wedge Machine Edge Torque Team	
			Used Belt	New Belt	Used Belt	New Belt
3V, 3VX	2.2- 2.4	1000-2500 2501-4000			3.3 2.9	4.9 4.3
	2.65-3.65	1000-2500 2501-4000	3.6 3.0	5.1 4.4	4.2 3.8	6.2 5.6
	4.12-6.90	1000-2500 2501-4000	4.9 4.4	7.3 6.6	5.3 4.9	7.9 7.3
5V, 5VX	4.4- 6.7	500-1749 1750-3000 3001-4000			10.2 8.8 5.6	15.2 13.2 8.5
	7.1-10.9	500-1740 1741-3000	12.7 11.2	18.9 16.7	14.8 13.7	22.1 20.1
	11.8-16.0	500-1740 1741-3000	15.5 14.6	23.4 21.8	17.1 16.8	25.5 25.0
8V	12.5-17.0	200- 850 851-1500	33.0 26.8	49.3 39.9		
	18.0-22.4	200- 850 851-1500	39.6 35.3	59.2 52.7		

MAINTENANCE

V-belt drives are recognized as an extremely reliable and efficient means of power transmission. Since they are basically trouble-free, they are often ignored and do not receive the minimal attention they do require in order to deliver the full benefits they offer and achieve the long life they should provide.

V-belt drive maintenance is not complicated, nor does it require a great deal of time or a large variety of special tools. The main ingredients of good maintenance are to look and listen to the drive, and then to correct any apparent problems.

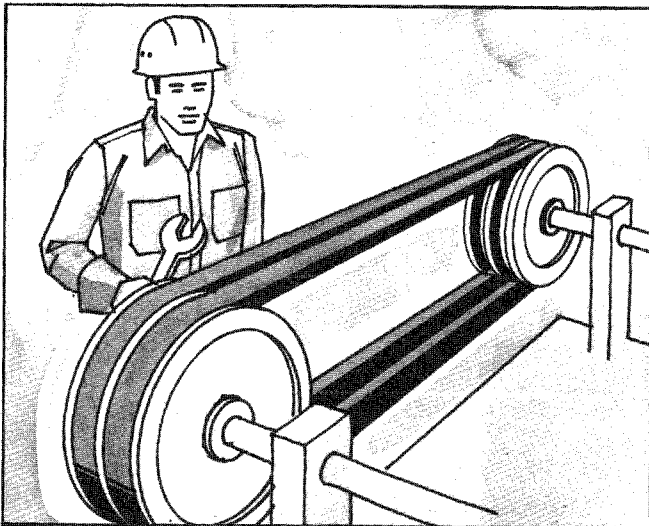
WARNING

Do not clean pulleys while the machine is running.

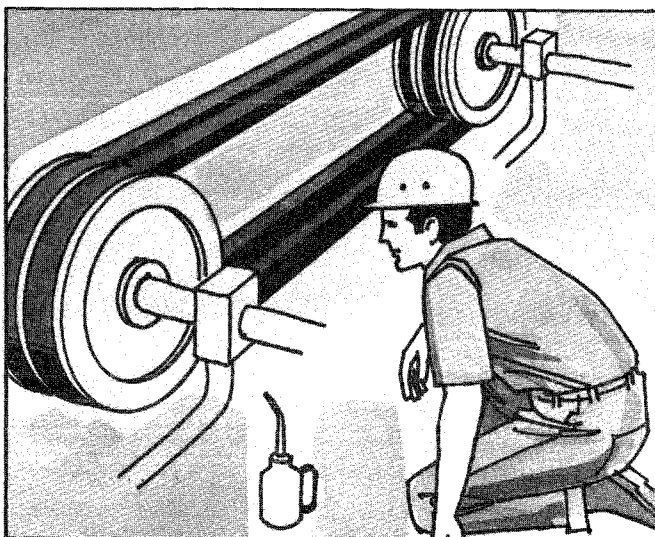
Disconnect power supply to the machine before removing or installing pulleys and belts.

Take pulleys off machines to inspect, clean and repair them.

Look and Listen



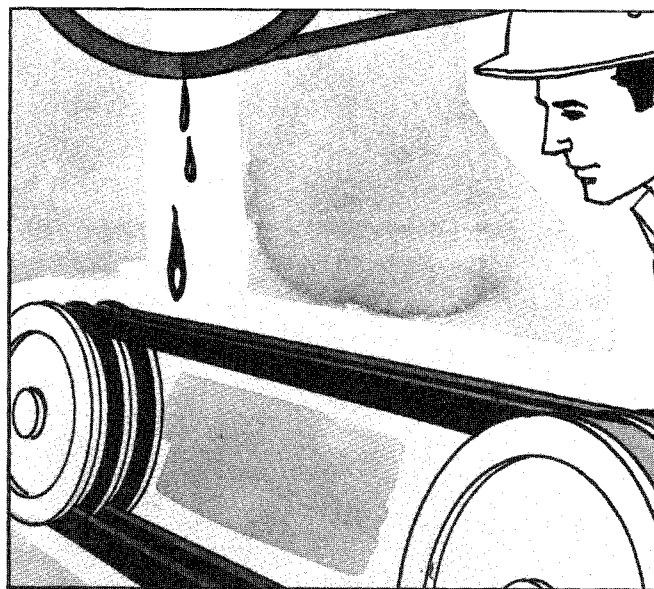
After installation or maintenance of belts, inspect the drive and watch it run.



Inspection of a V-belt drive is simply a matter of looking and listening.

WHAT TO LOOK FOR

1. OIL AND GREASE



Belts exposed to oil in spray, liquid or paste form will fail prematurely. A drive should be well policed. Leaky bearings should be repaired immediately. Excess oil on a bearing will splash on the belts. If these conditions cannot be corrected, special oil-resistant belts should be used. Too little lubrication will cause bearing failure which is often blamed on the belts. This condition may also cause belt failure when bearing drag becomes excessive.

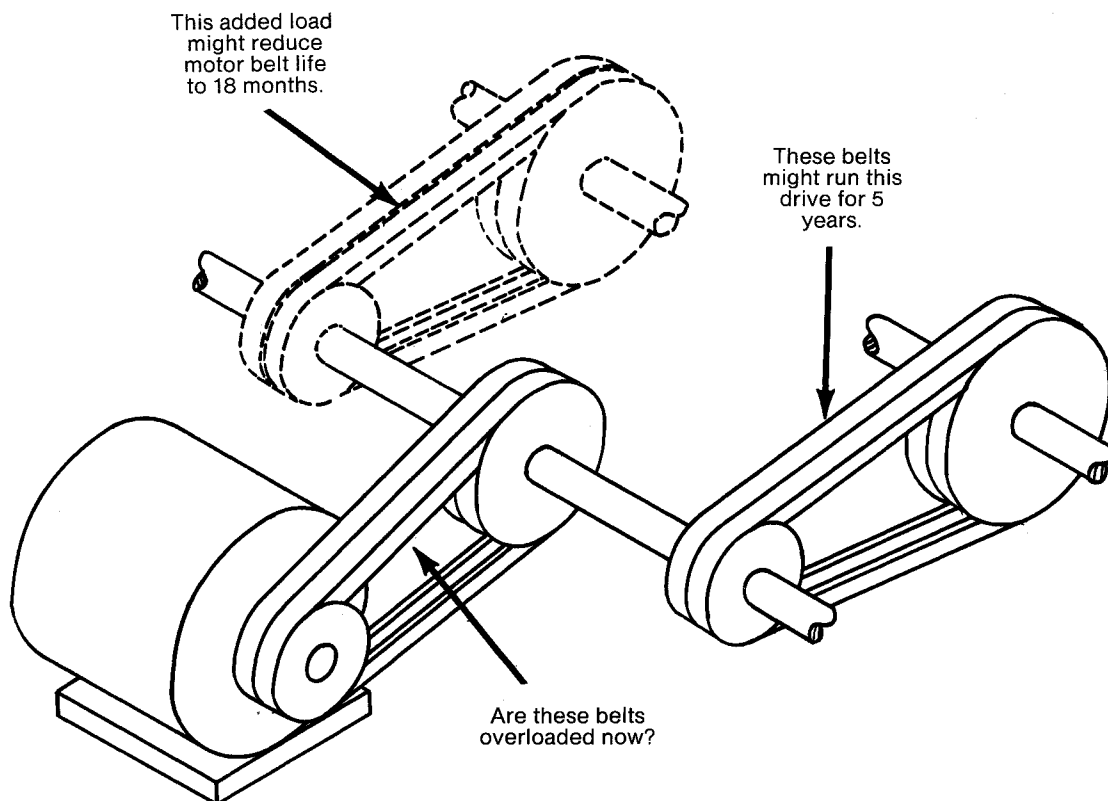
2. DIRT

No equipment operates best when it is dirty. Belts are no exception. Dirt accelerates belt wear and dirt build-up in a sheave groove impairs traction.



3. ADDED LOADS

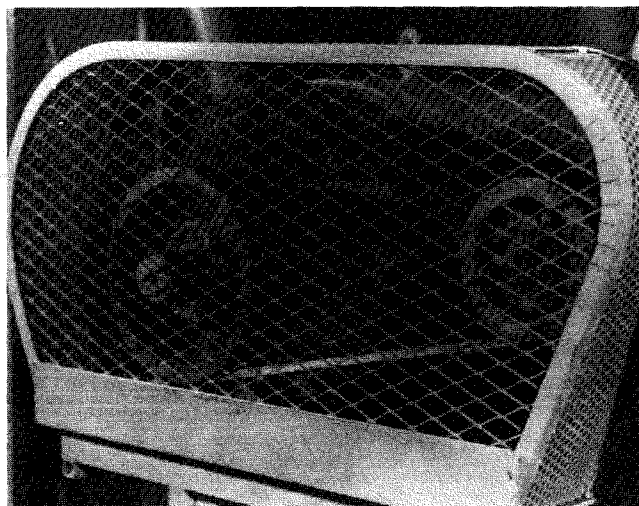
Added loads shorten belt life. A check should be made to see that no additional loads have been added since the original drive was selected.



4. BELT GUARDS

Belt guards insure cleanliness and safety. Screened, meshed or grided belt guards are the most satisfactory because they allow air to circulate and heat to escape.

NOTE: Belt guard openings should be as described in O.S.H.A. 1910.219, Table Q-12.



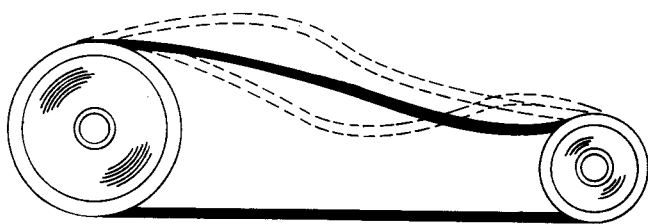
5. CRACKING

Bottom cracking will not reduce the tensile strength or the operating efficiency of the belt. It is not necessary to replace a belt simply because bottom cracking has been observed. High temperatures, small diameter pulleys, and dust will accelerate bottom cracks. Bottom cracking can be reduced by using larger sheaves and larger reverse bend idler sheaves.

6. BELT DRESSING

Do not use belt dressing of any kind. Certain dressings are meant to build a tacky surface, but only interfere with proper belt and groove fit as any other foreign material would. Other types attack the belt rubber and fabric to make it tacky. This actually accelerates the time to failure. If belts slip or squeak, the problem should be identified and corrected.

7. VIBRATION

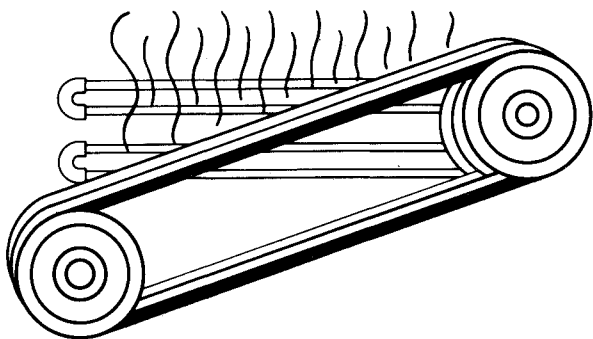


Prevent belt whipping.

8. TENSION

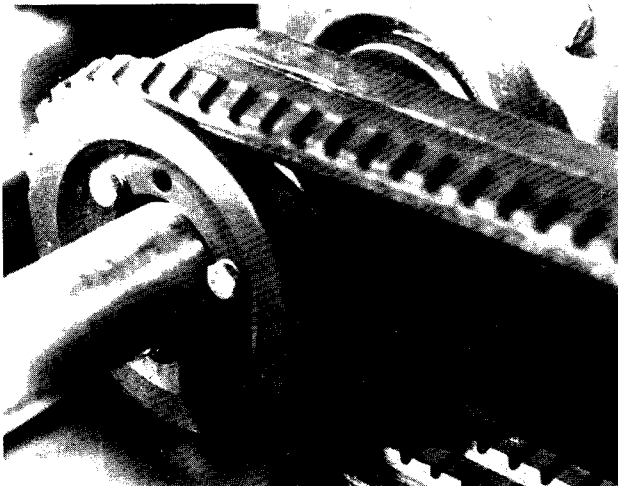
Adjust tension to the values shown in the tables provided in this *Guide*. See section on "Installation" for the type of belt involved for additional information.

9. HEAT



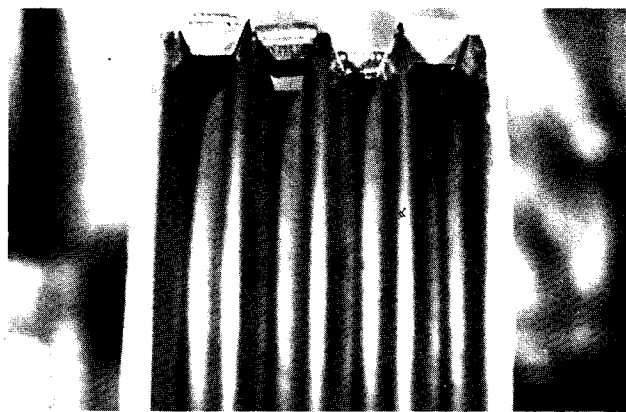
All belts are cured in a scientifically controlled time and temperature process. Belts which operate in temperatures of less than 140°F are not materially affected. At higher temperatures overcuring occurs and shortens belt life. Belts operating in temperatures above 140°F should be checked frequently and a special heat-resistant construction should be considered if belt life is not satisfactory.

10. BELT TURN OVER



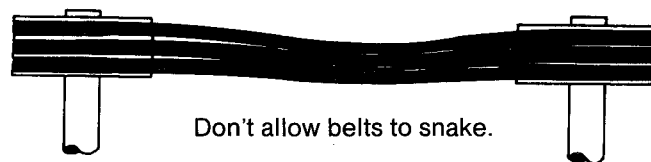
Turned over belts indicate drive misalignment, worn sheaves or excessive vibration.

11. CHANGE IN RIDE OUT



A change in ride out indicates uneven belt wear or worn sheaves.

12. LATERAL VIBRATION



Don't allow belts to snake.

13. BELT WEAR



Wear on belt sidewalls indicates consistent slippage, excessive dust, or rough sheaves.

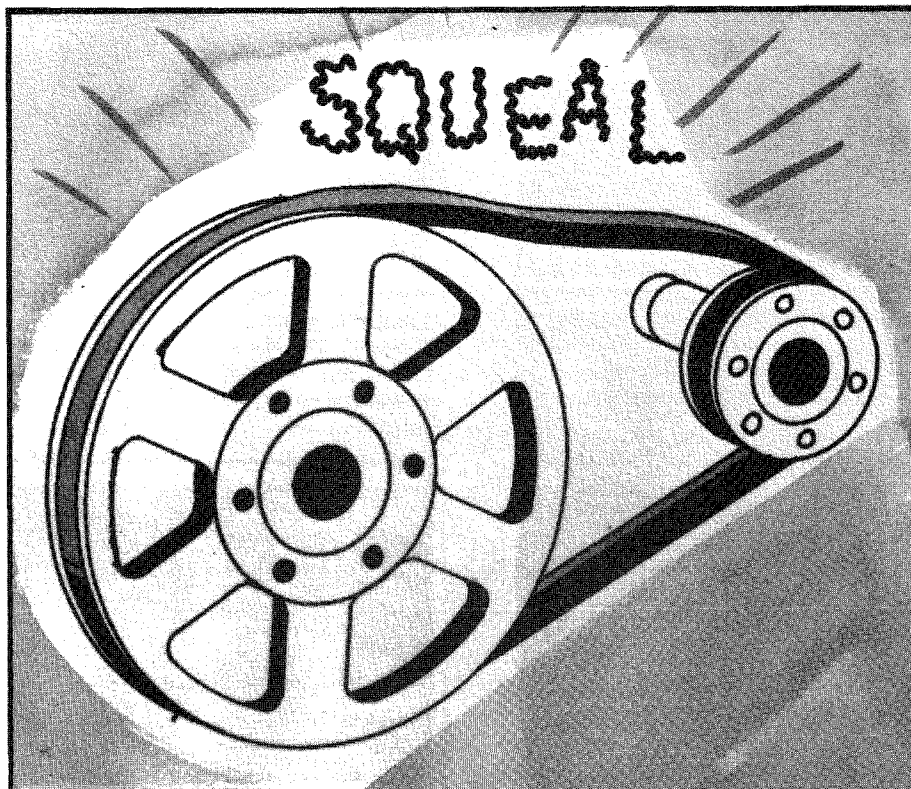
14. FOREIGN MATTER



Broken belts or excessive wear can result from the presence of foreign material in the sheaves or on the belts.

WHAT TO LISTEN FOR

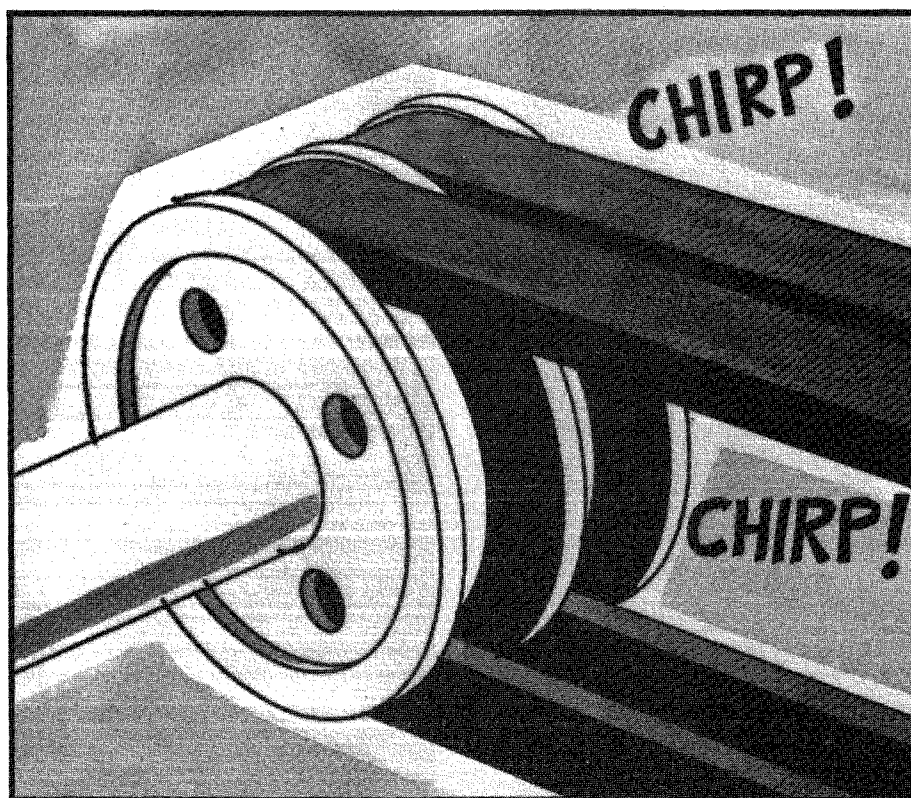
1. SQUEAL



Squeal noise occurs during motor acceleration or when the motor is operating near or at full load. It is an indication of belt slippage and requires prompt investigation. Squeal is usually

a result of insufficient belt tension. If it persists after all belts have been checked and their tension adjusted, the drive itself should be examined for overloading.

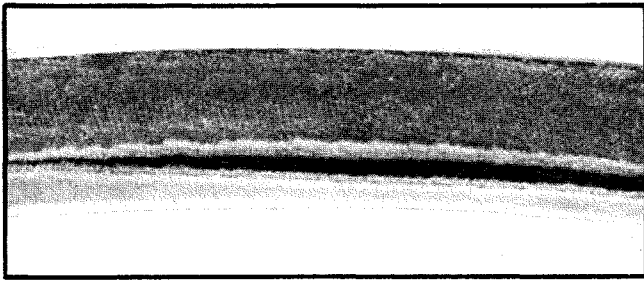
2. CHIRP OR SQUEAK



Chirp, a sound like that of a chirping bird, indicates a dry bearing. Chirp also occurs on all types and all makes of belts. Dust is often a contributing factor. Never apply dressing or

oil to a belt in an effort to eliminate chirps or squeaks. Realignment of an idler may help. Chirps or squeaks are often annoying, but will not harm belts.

TROUBLESHOOTING — V-BELT PERFORMANCE ANALYSIS



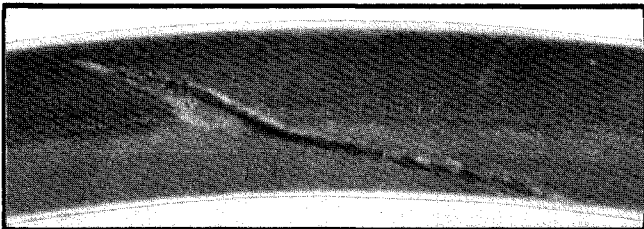
Cause of Failure — Excessive exposure to oil or grease has caused the belt to swell, become soft and the bottom envelope seam to "open up."

Correction — Provide splash guards, do not over lubricate, clean belts and sheaves with gasoline.



Cause of Failure — Weathering or "crazing" caused by the elements and aggravated by small sheaves.

Correction — Provide protection for the drive and replace belt or belts.



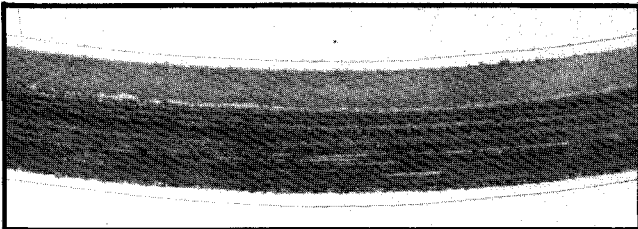
Cause of Failure — Cut bottom and sidewall indicate belt was pried over sheave and damaged during installation.

Correction — Be sure to use proper length belt and move tensioning all the way "in" when installing belt.



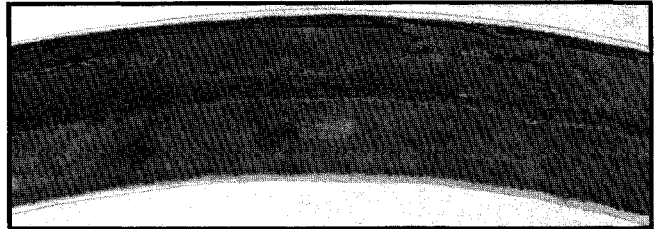
Cause of Failure — Severe localized wear caused by a frozen or locked driven sheave.

Correction — Determine that the drive components turn freely and tighten belt, if necessary.



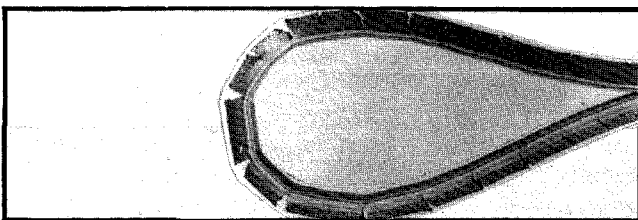
Cause of Failure — Constant slippage caused by insufficient tension in belt.

Correction — Tension drive in accordance with the recommendations of the equipment manufacturer and this manual.



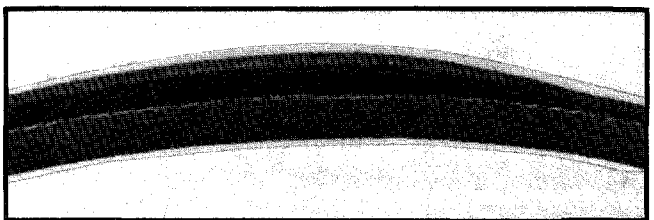
Cause of Failure — Rough sheave sidewalls cause the cover to wear off in an uneven pattern.

Correction — File or machine out the rough spot on the sheave groove. If beyond repair, replace the sheave.



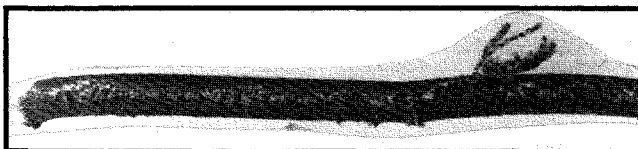
Cause of Failure — Belt has evenly spaced deep bottom cracks from use of a substandard backside idler.

Correction — Replace backside idler with the minimum size recommendation.



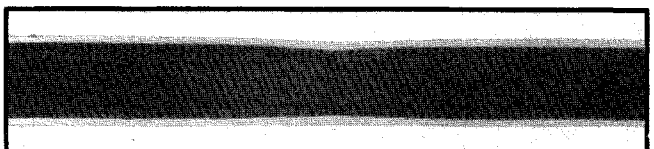
Cause of Failure — Ply separation caused by substandard sheave diameter.

Correction — Redesign drive to use proper size sheaves.



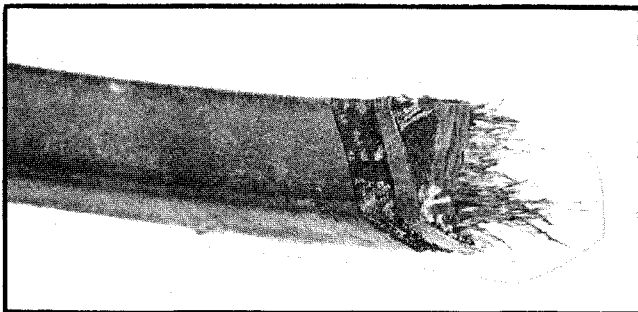
Cause of Failure — Split on side at the belt pitch line indicates use of a sheave with a substandard diameter.

Correction — Redesign drive to utilize proper size sheaves.



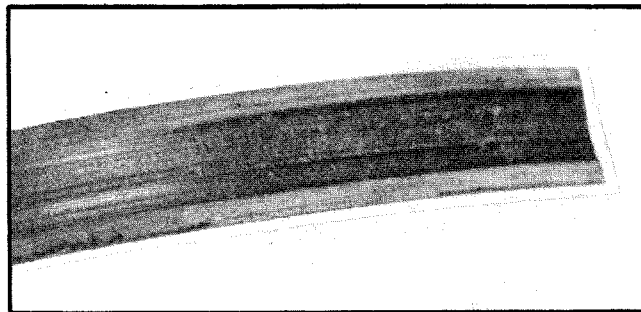
Cause of Failure — The load carrying member has been broken by a shock load or damage during installation.

Correction — Maintain proper tensioning and observe proper installation procedures.



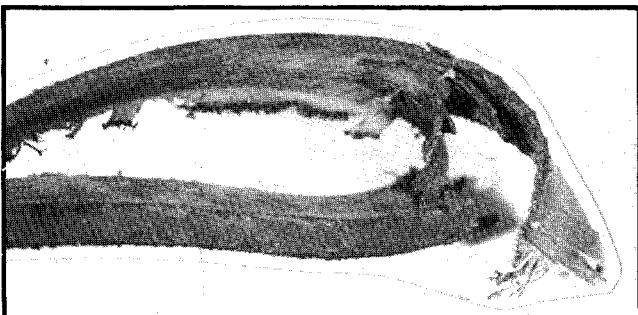
Cause of Failure — Tensile breaks can be caused by high shock loads, foreign object between the bottom of the sheave and the bottom of the belt or damage during installation.

Correction — Maintain proper drive tension and installation procedures. Provide guard to keep foreign material from coming in contact with the drive.



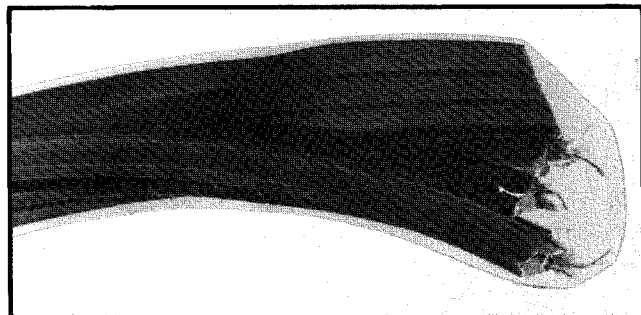
Cause of Failure — Back of the belt has been rubbing on a belt guard or other appurtenance.

Correction — Provide adequate clearance between belt and guard or any appurtenances.



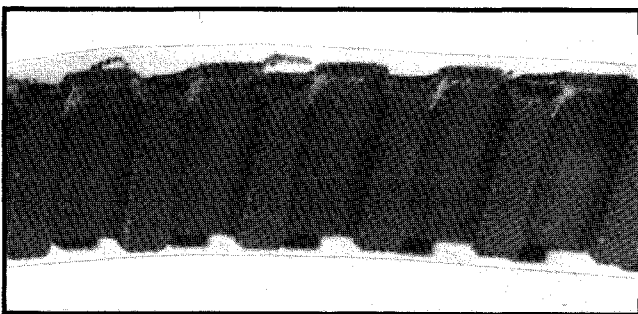
Cause of Failure — Excessive dust and rough sheaves combine to cause severe envelope wear and early belt failure.

Correction — Maintain sheave condition, alignment and attempt to protect drive from excessive dust exposure.



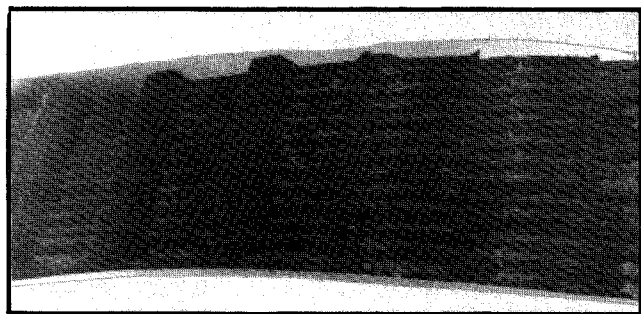
Cause of Failure — Worn sheave grooves allow the joined belt to ride too low cutting thru to the top band.

Correction — Replace sheaves and maintain proper belt tension and sheave alignment.



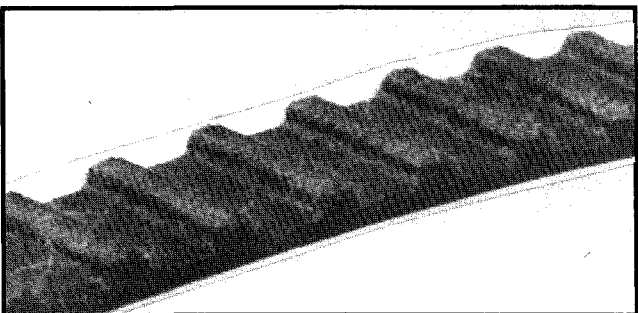
Cause of Failure — Flange wear on PD synchronous belt.

Correction — Adjust and maintain proper pulley alignment.



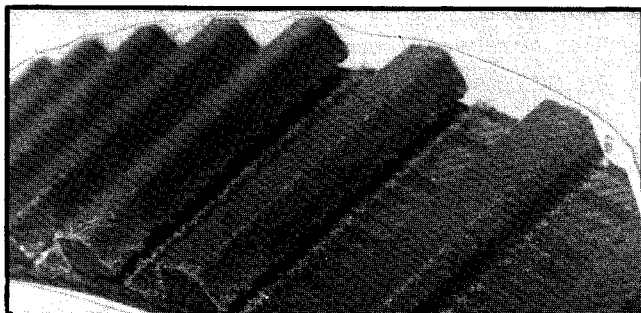
Cause of Failure — Web fabric wear caused by improper belt and pulley fit.

Correction — Check belt/pulley fit and replace worn or out-of-spec pulleys.



Cause of Failure — Tooth shear caused by belt overload condition from improper application or shock loads.

Correction — Consult engineering manual for proper application and maintain proper belt tension.



Cause of Failure — Fabric wear caused by insufficient belt tension or pulleys which are not to the standard PD pulley dimensions and tolerances.

Correction — Maintain proper tension and replace the out-of-spec pulleys.

PROBABLE CAUSES

PROBLEM

PROBLEM	Excessive Oil	Exposure to Elements	Pried Over Sheaves	Contact w/Obstruction	Insufficient Tension	Stalled Driven Sheave	Constant Slippage	Rough Sheaves	Substandard Sheaves	Excessive Tension	Shock Load	Foreign Material	Excessive Dust	Drive Misalignment	Worn Sheaves	Excessive Vibration	High Ambient Temperature	Excessive Tension	Drive Underbeltd	Inadequate Tension	Damage Tensile Member	Incorrect Belts	Incorrect Drive Setup	Insufficient Take Up	Improper Matching	Mixed Old & New Belts	Non Parallel Shafts	Different Manufacturers	Belt/Pulley, Incompatible
Loose Cover & Swell	X																												
Weathering or "Craze" Cracks		X																											
Gouges			X	X																									
Spin Burn					X	X																							
Envelope Wear							X						X																
Uneven Envelope Wear								X																					
Ply Separation									X	X																			
Side Split									X																				
Broken Belts											X	X																	
Belts Turn Over														X	X	X													
Hardening & Premature Cracking																	X												
Belt Squeal											X																		
Excessive Stretch															X			X	X										
Excessive Vibration					X																X								
Belts Too Long At Installation																						X	X	X					
Belts Too Short At Installation																						X	X	X					
Mismatched Belts At Installation															X										X	X	X	X	
Cut Thru on Top (Joined Belts)															X														
Flange Wear (Synchronous Belts)														X															
Web Fabric Wear (Synchronous Belts)																												X	
Tooth Shear (Synchronous Belts)											X								X		X								

SOLUTION

	Lubricate Properly	Clean Sheaves & Belt	Replace Belts	Provide Protection	Install Properly	Check for Belt Length	Remove Obstruction	Tension Properly	Free Sheaves	Replace Sheaves	File Smooth	Redesign Drive	Operate Properly	Align Drive	Provide Ventilation	Check for Proper Belt	Check Machinery	Use Only New Belts	Use Single Source	Check Fit	Replace Pulleys
Loose Cover & Swell	X	X																			
Weathering or "Craze" Cracks			X	X																	
Gouges					X	X	X														
Spin Burn	X							X	X												
Envelope Wear				X				X						X							
Uneven Envelope Wear										X	X										
Ply Separation					X							X									
Side Split												X									
Broken Belts				X	X								X								
Belts Turn Over										X				X							
Hardening & Premature Cracking															X						
Belt Squeal								X													
Excessive Stretch								X		X						X					
Excessive Vibration			X		X			X													
Belts Too Long At Installation																X	X				
Belts Too Short At Installation																X	X				
Mismatched Belts At Installation			X							X				X				X	X		
Cut Thru on Top (Joined Belts)										X											
Flange Wear (Synchronous Belts)														X							
Web Fabric Wear (Synchronous Belts)								X								X				X	X
Tooth Shear (Synchronous Belts)								X								X					

Metal face seals

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Metal face seals

General

SKF metal face seals type HDDF (→ **fig. 1**) are designed for use under severe service conditions at relatively low circumferential speeds. They offer reliable protection against solid and liquid contaminants as well as leak-proof retention of lubricants. The seals were originally developed for off-road and tracked vehicles, but have been found to be equally suitable for a range of other applications where effective protection is required against sand, soil, mud, water etc. (→ **fig. 2**). These applications include:

- all types of mixers
- sand treatment equipment
- conveyors and other construction equipment
- agricultural machinery
- washing equipment
- grinding mills and other pulverizing equipment
- ore dressing equipment
- mining equipment

Design features

HDDF seals consist of two identical metal sealing rings and two similar Belleville washers (cup springs) made of nitrile or fluoro rubber compounds, specifically developed for these seals (→ **fig. 3** on **page 383**). The sealing rings are made of wear- and corrosion-resistant cast alloy and have finely finished sliding and sealing surfaces.

The Belleville washers of nitrile or fluoro rubber provide the necessary uniform face loading and effective sealing at the bore and outside diameters. The outside diameter of the washers adapts to the form of the bore in which they are installed. It is critical that the bore diameter and bore depth are in accordance with the dimensions listed in the product table on **pages 384 to 387**. Adequate tolerances between the seal assembly and its mating component are critical to ensure a proper sealing performance.



Permissible operating conditions

Depending on their design, metal face seals can withstand different amounts of internal pressure. It should, however, generally be maintained below 0,25 MPa (35 psi). Other recommendations regarding operating conditions for the metal face seals, like temperature and speed, are provided in **table 1**.

The chemical resistance of the nitrile and fluoro rubber in general is dealt with in the section *Chemical resistance* on **page 35**.

Contaminants

Metal face seals are often used in heavily contaminated environments, where mud packing in the cavity between the housing, sealing rings and Belleville washers can occur. Eventually, the mud packing can cause the Belleville washers to be pushed out of position, resulting in improper face loads or mud being pumped past the Belleville washers.

Contaminants can also cause abrasion to the Belleville washers, which in turn causes deterioration of the elastomer. To minimize the risk of seal failure due to this deterioration, it is critical to select a proper Belleville washer material for the application in question.

Installing HDDF seals

General

Careful handling and installation of a metal face seal is critical to avoid cutting or tearing of the elastomeric Belleville washers or breaking the metal sealing rings, both which can cause premature seal failure and immediate leakage. It is also vital to keep the sealing faces free from contaminants like dirt or lint. Always carefully observe installation instructions provided on **page 383**.

Housing and seal preparation

All housing components contacting the Belleville washers must be free from contaminants (oil, grease, dust, lint particles etc.) when installing the seal. SKF recommends using a non-petroleum based solvent and a clean, lint-free wipe to clean these components prior to installation.

All seal parts must be handled with care to avoid damage or scoring.

Table 1

Table 1		
Permissible operating conditions		
Operating condition	Recommended value	
<hr/>		
Temperature, max		
Continuous operation		
Nitrile rubber (NBR)	-25 to +100 °C	(-15 to +210 °F)
Fluoro rubber (FKM)	-10 to +190 °C	(15 to 375 °F)
Circumferential speed, max		
Continuous operation	1,8 m/s	(350 ft/min)
Brief periods	3,8 m/s	(750 ft/min)
Pressure, max		
Continuous operation	0,25 MPa	(35 psi)
Brief periods	0,35 MPa	(50 psi)

Installation procedure

- 1 Install the Belleville washers seated against the inside shoulder of the metal sealing rings (→ fig. 4a).
- 2 Carefully push each seal half (Belleville washer and metal sealing ring) into the housing until it is fully seated. Check that the seal is not cocked and that the washers are seated evenly at the bottom of the housing bore. Improper seal installation can result in uneven face loads around the circumference of the seal faces, causing scoring or the sealing rings to separate and allow oil to leak.
- 3 Clean both metal sealing ring faces with a lint-free wipe and apply a thin film of oil. Ensure that no oil is applied to any surface but the sealing ring faces (→ fig. 4b).
- 4 Check that both housings are concentric and in correct alignment. The Belleville washers must not unseat from the bottom of the housing.
- 5 Carefully bring the two housings together, avoiding high impact that can scratch or break the seal components.
- 6 Finally, hold one half of the assembly stationary while rotating the other half at least ten complete revolutions.

NOTE: This procedure enables the installer to check that the housing and the Belleville washers are aligned. If the seal assembly wobbles, it is necessary to disassemble it and make sure that the Belleville washers are properly seated in the housing.

Fig. 3

Design features

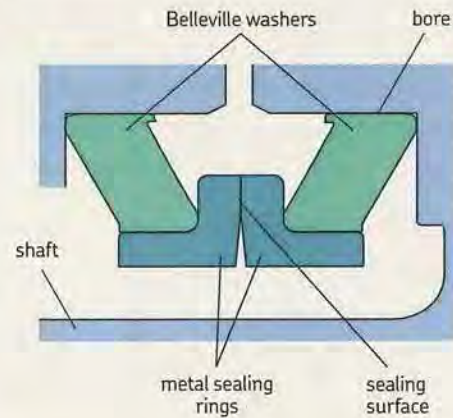
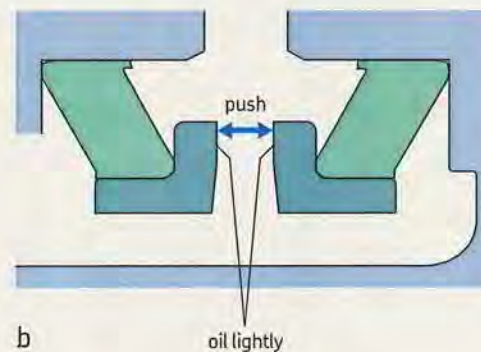
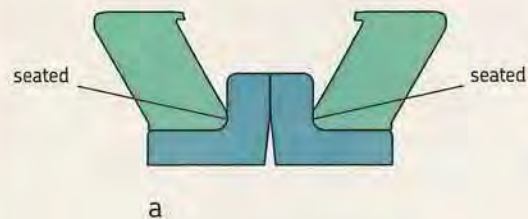


Fig. 4

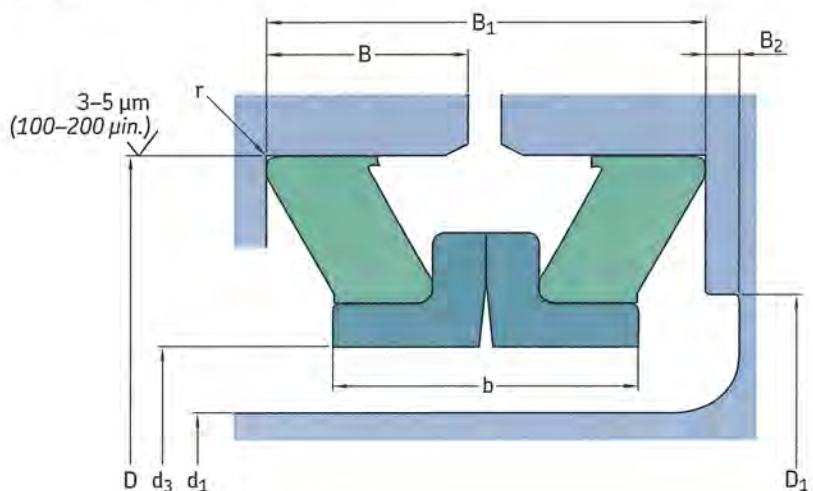
Installation procedure



Metal face seals – HDDF – inch and metric dimensions

d_1 1.688 – 7.800 in.

d_1 42,88 – 198,12 mm



Designation	Lip material	Inch dimensions		Operating width	Seal inside diameter	Bore depth	Recommended shoulder diameter		Under-cut	Sealing ring width	Radius
		Shaft diameter d_1 max	Bore diameter D	B_1	d_3 min	B	D_1 max	min	B_2 min	b max	r max
–	–	in.									
16904	R	1.688	2.760 ±0.002	0.974 ±0.038	1.760	0.453	2.282	–	–	0.846	0.037
18259	R	1.812	3.003 ±0.002	0.892 ±0.031	1.910	0.416	2.475	–	–	0.790	0.042
21215	R	2.125	3.250 ±0.002	0.900 ±0.033	2.215	0.418	2.759	–	–	0.812	0.045
25096	R	2.500	3.762 ±0.002	0.907 ±0.033	2.580	0.422	3.188	–	–	0.840	0.042
27536	R	2.750	4.030 ±0.002	0.918 ±0.035	2.830	0.426	3.480	–	–	0.810	0.042
30651	R	3.063	4.500 ±0.002	1.016 ±0.035	3.170	0.475	3.833	–	–	0.912	0.042
35076	R	3.500	4.953 ±0.002	1.096 ±0.043	3.620	0.511	4.296	–	–	0.962	0.035
38740	R	3.875	5.312 ±0.003	1.102 ±0.024	4.040	0.524	4.750	–	–	1.002	0.042
38751	R	3.875	5.562 ±0.003	1.267 ±0.050	4.040	0.594	4.791	–	–	1.110	0.051
43135	R	4.312	5.823 ±0.003	1.102 ±0.024	4.420	0.524	5.125	–	–	1.002	0.042
43150	R	4.312	6.000 ±0.003	1.320 ±0.040	4.420	0.625	5.173	–	–	1.090	0.051
46975	R	4.688	6.400 ±0.003	1.525 ±0.050	4.795	0.722	5.583	–	–	1.254	0.047
50655	R	5.062	6.750 ±0.003	1.280 ±0.040	5.170	0.605	5.975	–	–	1.150	0.057
54000	R	5.400	6.990 ±0.003	1.310 ±0.030	5.625	0.625	6.625	–	–	1.182	0.057
56170	R	5.625	7.250 ±0.003	1.366 ±0.031	5.825	0.650	6.486	6.174	0.032	1.300	0.057
58775	R	5.875	7.641 ±0.003	1.510 ±0.031	6.000	0.724	6.868	6.548	0.056	1.490	0.073
63796	R	6.375	8.120 ±0.003	1.265 ±0.040	6.570	0.598	7.555	7.505	0.125	1.350	0.042
67560	R	6.750	8.620 ±0.004	1.375 ±0.030	6.920	0.656	7.750	–	–	1.260	0.042
74310	R	7.438	9.400 ±0.004	1.656 ±0.040	7.540	0.793	8.431	–	–	1.344	0.073
78020	R	7.800	10.000 ±0.004	1.750 ±0.050	7.940	0.835	8.910	–	–	1.500	0.058



Description **EXTREME DUTY (TM) SLUDGE MIXER**

Parts List Number **36928**
Job Name **SOUTHSIDE WWTP GAS**
Job Number **22397A**
Model No **SME1**

Rev. **D**

Quantity **4**
Size **36" DIA**
Type **SLUDGE MIXER**
Weight **48,055** lbs

Date **1/12/2015**
Designer **BE43**
Checked **ST20**
Approved **MO101**

Item Number	Quantity per Assembly	Quantity per order	Units	Part Number	Document Number	Doc Rev	Description of Parts	Material	Weight per Item	Line Rev
101	1	4	EACH	1020A	1020	0	SHAFT HOUSING	STL	1459	-
102	1	4	EACH	1021A	1021	0	MOTOR MOUNT (FOR FRAME 284T)	STL	133	-
103										
104	1	3	EACH	1022A	1022	0	IMPELLER SHAFT-6" DIA.	CRS	1216	D
105										
106	1	4	EACH	1023A	1023	A	BELT GUARD	304L	99	A
107	1	4	EACH	1024A	1024	0	BELT GUARD COVER	304L	47	-
108										
109										
110	1	3	EACH	1025A	1025	0	FLOW DEFLECTOR	STL	311	D
111	1	4	EACH	SMXDT095A	SMXDT095	0	WEAR SLEEVE	STL	1	-
112										
113	2	8	EACH	1041A	1041	-	BAFFLE	STL	23	A
114	2	8	EACH	1041B	1041	-	BAFFLE	STL	38	A
115										
116	1	4	EACH	SMXDT092A	SMXDT092	A	LOWER BEARING PLATE	STL	35	-
117	1	4	EACH	SMXDT093A	SMXDT093	B	LOWER BEARING HOUSING	STL	77	-
118	1	4	EACH	SMXDT094A	SMXDT094	C	LOWER SEAL HOUSING	STL	24	-
119										
120	1	4	EACH	SMXDT091A	SMXDT091	A	UPPER BEARING HOUSING	STL	100	-
121	1	4	EACH	SMXDT090A	SMXDT090	A	UPPER BEARING COVER	STL	91	-
122										
123	1	4	EACH	SMXDT073A	SMXDT073	A	LUBRICATION LEGEND	ACRYLIC		-
124										

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Item Number	Quantity per Assembly	Quantity per order	Units	Part Number	Document Number	Doc Rev	Description of Parts	Material	Weight per Item	Line Rev
125	1	4	EACH	SMXDT006A	SMXDT006	0	IMPELLER NUT	STL	5	-
126										
127	1	4	EACH	SMXDT004A	SMXDT004	B	36" DIA IMPELLER	CI	560	A
128										
129	1	4	EACH	SMXDT041A	SMXDT041	A	GREASE DRIP PAN	STL	2	-
130	1	4	EACH	SMXDT114A	SMXDT114	0	UPPER CLAMP NUT (USE ITEM 215)	STL		-
131	1	4	EACH	SMXDT096A	SMXDT096	A	CLAMP NUT (USE ITEM 217)	STL		-
132	1	4	EACH	1026A-D	1026	-	MIXER I.D. TAG	SST		-
133	1	4	EACH	SMXDT050	SMXDT050	0	STORAGE PROCEDURE SIGN	ACRYLIC		-
134	1	4	EACH	SMXDT021A	SMXDT021	0	GREASE RELIEF PIPE	304		-
135	1	4	EACH	BO	-----		MOTOR - SINGLE SPEED, REVERSIBLE, CLASS 1, DIV 1, 1200RPM, 230/460V, 3PH, 60 Hz, 15HP - W/ SPACE HEATER	---		-
136	1	4	EACH	BO	-----		MOTOR SLIDE BASE	STL		-
137										
138	1	4	EACH	BO	-----		MOTOR SHEAVE (5.90" DIA.) 3 GROOVE TAPER-LOCK	STL		-
139	1	4	EACH	BO	-----		MOTOR BUSHING (1 7/8" BORE) TAPER-LOCK	STL		-
140										
141	1	4	EACH	BO	-----		MIXER SHEAVE (37.5" DIA.) 3 GROOVE TAPER-LOCK	STL		-
142	1	4	EACH	BO	-----		MIXER BUSHING (2 7/16" BORE) TAPER-LOCK	STL		-
143										
144	3	12	EACH	BO	-----		DRIVE BELT (132" LONG)	---		-
145										
146	1	4	EACH	BO	-----		LOWER BEARING	---		-
147	1	4	SET	BO	-----		UPPER BEARING ASSEMBLY	---		-
148										
149										C

Item Number	Quantity per Assembl y	Quantity per order	Units	Part Number	Document Number	Doc Rev	Description of Parts	Material	Weight per Item	Line Rev
150	1	4	EACH	BO	-----		HEX SOCKET HD CAPSCREW 8-32 X 1" LG (FULL THREAD)	STL		-
201										
202	1	4	EACH	BO	-----		DUST SEAL	---		-
203	1	4	EACH	BO	-----		UPPER LIP SEAL	---		-
204	1	4	EACH	BO	-----		UPPER BEARING SEAL	---		-
205	1	4	EACH	BO	-----		LOWER LIP SEAL	---		-
206										
207	1	4	EACH	BO	-----		MECHANICAL SEAL	---		-
208										
209	1	4	EACH	BO	-----		O-RING (UPPER BEARING HOUSING)	NBR		-
210	2	8	EACH	BO	-----		O-RING (LOWER BEARING PLATE)	NBR		-
211	4	16	EACH	BO	-----		O-RING (LOWER GREASE LINES)	NBR		-
212	1	4	EACH	BO	-----		O-RING (LOWER SEAL HOUSING)	NBR		-
213										
214	1	4	EACH	BO	-----		LOCK NUT	STL		-
215	1	4	EACH	BO	-----		UPPER CLAMP NUT	STL		-
216	1	4	EACH	BO	-----		SHAFT COLLAR	STL		-
217	1	4	EACH	BO	-----		CLAMP NUT	STL		-
218										
219	2	8	EACH	BO	-----		VALVE PLUG	BRS		-
220	1	1	EACH	BO	-----		VALVE COUPLER	BRS		-
221	1	1	EACH	BO	-----		GREASE GUN	---		-
222	1	1	EACH	BO	-----		NGLI 000 GREASE (35 LB. PAIL)	---		-
223										
224	2	8	EACH	BO	-----		1/4" NPT HEX SOCKET PLUG	---		-
225	4	16	EACH	BO	-----		DRAW LATCH	SST		-
226										
227										
228	2	8	EACH	BO	-----		PLUG, 3/4" NPT	BRS		-

Item Number	Quantity per Assembly	Quantity per order	Units	Part Number	Document Number	Doc Rev	Description of Parts	Material	Weight per Item	Line Rev
229	2	8	EACH	BO	-----		1/4" PIPE NIPPLE x CLOSE	304		-
230	1	4	EACH	BO	-----		1/4" PIPE NIPPLE x 14"	304		-
231	1	4	EACH	BO	-----		1/4" PIPE NIPPLE x 2"	304		-
232	1	4	EACH	BO	-----		1/4" 90 THREADED ELBOW	304		-
233	1	4	EACH	BO	-----		1/4" x 1/8" NPT REDUCER COUPLING	304		-
234	1	4	EACH	BO	-----		1/8" NPT GREASE RELIEF FITTING, 5 psi	304		-
235	1	2	EACH	BO	-----		SPANNER WRENCH (SHAFT LOCK NUT)	---		-
236										
237	1	4	EACH	SIT-00008A	SIT-00008 A	0	WESTECH NAMEPLATE, LARGE	CAST AL		-
238										
239	1	4	EACH	1027A	1027	0	GASKET - MIXER TO DRAFT TUBE	NPRN CC		-
240										
241	4	16	EACH	SMXDT043A	SMXDT043	A	GUIDE BAR	UHMWPE		-
242										
243										
244										
245										
246										
247										
248							SHOP ASSEMBLY FASTENERS			
249										
250	8	32	EACH	BO	-----		CAPSCREW HEX HD 1/2" X 1 1/2" (UHMW GUIDE BARS)			-
301	8	32	EACH	BO	-----		HEX NUT 1/2" W/ (2) FW (UHMW GUIDE BARS)			-
302										
303	1	4	EACH	BO	-----		ANTI-SIEZE LUBRICANT (8 oz. TUBE), NICKEL BASE	---		-
304										
305	6	24	EACH	BO	-----		CAPSCREW HEX HD 5/8" X 2" (MOTOR MOUNT TO SHAFT HOUSING)	316		-

Item Number	Quantity per Assembly	Quantity per order	Units	Part Number	Document Number	Doc Rev	Description of Parts	Material	Weight per Item	Line Rev
306	6	24	EACH	BO	-----		HEX NUT 5/8" W/ FW (MOTOR MOUNT TO SHAFT HOUSING)	316		-
307										
308	4	16	EACH	BO	-----		HX SOCKET HD CAPSCREW 1/2" X 8" (UPPER BEARING HOUSING)	316		-
309	4	16	EACH	BO	-----		HEX NUT 1/2" W/ LW (UPPER BEARING HOUSING)	316		-
310										
311	8	32	EACH	BO	-----		CAPSCREW SOCKET HD, 1/2" X 4" (LOWER BEARING HOUSING)	316		-
312										
313										
314	4	16	EACH	BO	-----		CAPSCREW HEX HD 3/8" X 1 1/4" (BELT GUARD TO SHAFT HOUSING)	316		-
315	4	16	EACH	BO	-----		HEX NUT 3/8" W/ FW (BELT GUARD TO SHAFT HOUSING)	316		-
316										
317	12	48	EACH	BO	-----		HEX NUT 3/4" W/ FW (FLOW DEFLECTOR TO SHAFT HOUSING)	316		-
318										
319										
320	1	4	EACH	BO	-----		HEX SOCKET SET SCREW 5/16 X 1" LG - CONE POINT (CLAMP NUT TO LOWER SEAL HOUSING)	STL		-
321										
322										
323	2	8	EACH	BO	-----		HEX SOCKET SET SCREW 1/2" X 1" LG (IMPELLER)	SST		-
324										
325										
326	1	4	EACH	BO	-----		ROLL PIN 3/8" DIA x 3" LG (IMPELLER NUT)	SST		-
327										
328										

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Item Number	Quantity per Assembly	Quantity per order	Units	Part Number	Document Number	Doc Rev	Description of Parts	Material	Weight per Item	Line Rev
329	1	4	EACH	BO	-----		KEY STOCK 5/8" SQ X 3" LG (MIXER SHEAVE TO SHAFT)	SST	-	-
330										
331										
332	1	4	EACH	BO	-----		KEYSTOCK 5/8" SQ. x 2 1/4" LG (IMPELLER TO SHAFT)	SST	-	-
333										
334										
335	4	16	EACH	BO	-----		CAPSCREW HEX HD 1/2" X 1 3/4" (MOTOR SLIDE BASE TO MOTOR MOUNT)	316	-	-
336	4	16	EACH	BO	-----		HEX NUT 1/2" W/ FW (MOTOR SLIDE BASE TO MOTOR MOUNT)	316	-	-
337										
338	2	8	EACH	BO	-----		CAPSCREW HEX HD 3/8" X 5/8" (BELT GUARD TO UPPER BEARING COVER)	316	-	-
339	2	8	EACH	BO	-----		FW 3/8" (BELT GUARD TO UPPER BEARING COVER)	316	-	-
340										
341	2	8	EACH	BO	-----		CAPSCREW HEX HD 1/4" X 1 1/4" (WESTECH NAME PLATE)	316	-	-
342	2	8	EACH	BO	-----		HEX NUT 1/4" W/ FW (WESTECH NAME PLATE)	316	-	-
343										
344	1	4	EACH	BO	-----		HEX SOCKET HD CAPSCREW 8-32 X 1/2" LG-FULL THREAD (LOWER SEAL HOUSING)	316	-	-
345										
346										
347	4	16	EACH	BO	-----		CAPSCREW HEX HD 1/2" X 1 1/2" (UPPER BEARING HOUSING)	316	-	-
348	4	16	EACH	BO			1/2" LOCKWASHER (UPPER BEARING HOUSING)	316	-	-
349										
350	1	4	EACH	BO	-----		HEX SOCKET SET SCREW 3/8" UNC x 1"	316	-	-

Item Number	Quantity per Assembly	Quantity per order	Units	Part Number	Document Number	Doc Rev	Description of Parts	Material	Weight per Item	Line Rev
351										
352	20	80	EACH BO				CAPSCREW HEX HD 3/8-16NC X 1 1/2" (BAFFLE)	316		A
353	20	80	EACH BO				3/8" FLAT WASHER (BAFFLE)	316		A
354	1	1	EACH BO				4 OZ. CAN LEAK LOCK, THREAD LOCK (BAFFLE)			A
401										
402							FIELD FASTENERS:			
403	32	128	EACH BO		-----		CAPSCREW HEX HD 5/8" X 2 1/4" (SHAFT HOUSING TO DRAFT TUBE)	316		-
404	32	128	EACH BO		-----		HEX NUT 5/8" W/ FW (SHAFT HOUSING TO DRAFT TUBE)	316		-
405										
406	144	144	EACH BO		-----		CAPSCREW HEX HD 1/2" X 1 3/4" (HANDRAIL & DRAFT TUBE TO PLATFORM)	316		-
407	64	64	EACH BO		-----		HEX NUT 1/2" W/ FW (HANDRAIL TO PLATFORM)	316		-
408	20	80	EACH BO		-----		HEX NUT 1/2" W/ BW (DRAFT TUBE TO PLATFORM)	316		-
409	34	34	EACH BO		-----		CAPSCREW HEX HD 5/8" x 1 3/4" (PLATFORM BRACES TO PLATFORM/ DRAFT TUBE)	316		-
410	34	34	EACH BO		-----		HEX NUT 5/8" W/ (2) FW (PLATFORM BRACES TO PLATFORM/ DRAFT TUBE)	316		-
411										
412	4	16	EACH BO		-----		3/4" X 9 1/2" EPOXY ANCHOR (DRAFT TUBE BASE)	316		-
413	4	16	EACH BO		-----		3/4" HEX NUT W/ FW (DRAFT TUBE BASE)	316		-
414										
415	4	16	EACH BO		-----		5/8" X 8" EPOXY ANCHOR (PLATFORMS)	316		-
416	4	16	EACH BO		-----		5/8" HEX NUT W/ FW (PLATFORMS)	316		-
417										
418	5	5	EACH BO		-----		HIT-HY 200-A MAX-SD EPOXY (11.1 fl oz/330 ml)	---		-

Item Number	Quantity per Assembly	Quantity per order	Units	Part Number	Document Number	Doc Rev	Description of Parts	Material	Weight per Item	Line Rev
419	1	1	EACH	BO	-----		MANUAL DISPENSER HDM 500 + BLACK/RED CARTR	---	-	-
420	1	1	EACH	BO	-----		HIT-RBH (T-HANDLE) (FOR BRUSHES)	---	-	-
421	1	1	EACH	BO	-----		HIT-RB 3/4" BRUSH	---	-	-
422	1	1	EACH	BO	-----		HIT-RB 5/8" BRUSH	---	-	-
423	1	1	EACH	BO	-----		BLOW OUT PUMP	---	-	-
424										
425							FABRICATED ITEMS:			
427	1	2	EACH	1028A	1028-1,2,3	B	DRAFT TUBE (FOR S080-DIG1-MXR02 & S080-DIG1-MXR04)	STL	4698	B
428	1	1	EACH	1028B	1028-1,2,3	B	CUSTOM DRAFT TUBE #1 (FOR S080-DIG1-MXR01)	STL	4698	B
429	1	1	EACH	1028C	1028-1,2,3	B	CUSTOM DRAFT TUBE #3 (FOR S080-DIG1-MXR03)	STL	4698	B
430	2	8	EACH	1029A	1029	-	DRAFT TUBE INLET/OUTLET	STL	900	-
431										
432	1	2	EACH	1030A	1030	A	STANDARD PLATFORM (FOR S080-DIG1-MXR02 & S080-DIG1-MXR04)	HDG STL	849	A
433	1	2	EACH	1031A	1031	-	STANDARD PLATFORM GRATING (FOR S080-DIG1-MXR02 & S080-DIG1-MXR04)	AL	-	-
434	1	2	LOT	1032A	1032	-	STANDARD PLATFORM HANDRAIL (FOR S080-DIG1-MXR02 & S080-DIG1-MXR04)	AL	-	-
435	1	1	EACH	1033A	1033-1,2	B	CUSTOM PLATFORM #1 (FOR S080-DIG1-MXR01)	HDG STL	892	B
436	1	1	EACH	1034A	1034	-	CUSTOM PLATFORM #1 GRATING (FOR S080-DIG1-MXR01)	AL	-	-
437	1	1	LOT	1035A	1035	-	CUSTOM PLATFORM #1 HANDRAIL (FOR S080-DIG1-MXR01)	AL	-	-
438	1	1	EACH	1036A	1036	B	CUSTOM PLATFORM #3 (FOR S080-DIG1-MXR03)	HDG STL	941	B
439	1	1	EACH	1037A	1037	-	CUSTOM PLATFORM #3 GRATING (FOR S080-DIG1-MXR03)	AL	-	-

Item Number	Quantity per Assembly	Quantity per order	Units	Part Number	Document Number	Doc Rev	Description of Parts	Material	Weight per Item	Line Rev
440	1	1	LOT	1038A	1038	-	CUSTOM PLATFORM #3 HANDRAIL (FOR S080-DIG1-MXR03)	AL	-	-
441	1	4	EACH	1040A	1040	A	PLATFORM BEAM	HDG STL	50	A
442	2	2	EACH	1039A	1039	A	PLATFORM BRACE (FOR S080-DIG1-MXR02 & S080-DIG1-MXR04)	HDG STL	51	A
443	2	2	EACH	1039B	1039	A	PLATFORM BRACE (FOR S080-DIG1-MXR02 & S080-DIG1-MXR04)	HDG STL	64	A
444	1	1	EACH	1039C	1039	A	PLATFORM BRACE (FOR S080-DIG1-MXR01)	HDG STL	138	A
445	1	1	EACH	1039D	1039	A	PLATFORM BRACE (FOR S080-DIG1-MXR01)	HDG STL	111	A
446	2	2	EACH	1039F	1039	A	PLATFORM BRACE (FOR S080-DIG1-MXR01)	HDG STL	115	A
447										
448	1	1	EACH	1039G	1039	A	PLATFORM BRACE (FOR S080-DIG1-MXR03)	HDG STL	95	A
449	1	1	EACH	1039H	1039	A	PLATFORM BRACE (FOR S080-DIG1-MXR03)	HDG STL	82	A
450	1	1	EACH	1039J	1039	A	PLATFORM BRACE (FOR S080-DIG1-MXR03)	HDG STL	78	A
451	1	1	EACH	1039K	1039	A	PLATFORM BRACE (FOR S080-DIG1-MXR03)	HDG STL	77	A
452	1	1	EACH	1039M	1039	A	PLATFORM BRACE (FOR S080-DIG1-MXR03)	HDG STL	75	A
453										
454							SPARE PARTS:			
455	3	3	EACH	BO	-----		DRIVE BELT (132" LONG)	---	-	-
456										
457	1	1	EACH	BO	-----		LOWER BEARING	---	-	-
458	1	1	SET	BO	-----		UPPER BEARING ASSEMBLY	---	-	-
459										
460	1	1	EACH	BO	-----		DUST SEAL	---	-	-
461	1	1	EACH	BO	-----		UPPER LIP SEAL	---	-	-
462	1	1	EACH	BO	-----		UPPER BEARING SEAL	---	-	-
463	1	1	EACH	BO	-----		LOWER LIP SEAL	---	-	-
464	1	1	EACH	BO	-----		MECHANICAL SEAL	---	-	-
465	1	1	EACH	BO	-----		O-RING (UPPER BEARING HOUSING)	NBR	-	-
466	2	2	EACH	BO	-----		O-RING (LOWER BEARING PLATE)	NBR	-	-
467	4	4	EACH	BO	-----		O-RING (LOWER GREASE LINES)	NBR	-	-

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Item Number	Quantity per Assembl y	Quantity per order	Units	Part Number	Document Number	Doc Rev	Description of Parts	Material	Weight per Item	Line Rev
468	1	1	EACH	BO	-----		O-RING (LOWER SEAL HOUSING)	NBR		-
469										
470										
471							-----MIXER NO. 1 AS BUILT-----			
472										-
473	1	1	EA	1042A	1042	-	MIXER NO. 1 IMPELLER SHAFT - 6" DIA.	STL	1281	D
474	1	1	EA	1043A	1043	-	MIXER NO. 1 FLOW DEFLECTOR	STL	334	D
475										-
476										-
477							-----END-----			-

4 Specific Requirements for Each Bid Item

4.5 Bid Item 5

	Item Description
Bid Item 5	Prepare Digester 1 for <u>Inspection</u> by providing ventilation, scaffolding, power washing, and lighting inside the digester.

4.5.1 Summary of Proposed Work

After cleaning of the digester, Contractor is to do the following:

- Provide ventilation.
- Erect scaffolding inside the digester.
- Power wash the underside of the digester ceiling.
- Provide lighting inside the digester.

4.5.2 Contractor's Responsibility

- Refer to Section 3.1 of the *Common Requirements for All Bid Items* for Contractor's Responsibility.

4.5.3 Ventilation

- Contractor is to provide an OSHA compliant work space within the digester. This includes forced air ventilation and atmospheric testing.

4.5.4 Scaffolding

- Contractor is to provide scaffolding across the diameter of the digester. The scaffolding should span from the perimeter on one side to the center, and then from the center to the perimeter on the opposite side. Based on the structures inside the digester, it may not be reasonable to have the scaffolding span across as a straight diameter. The Contractor may elect to span the scaffolding using 2 or more radii.
- The standing surface of the scaffolding should be between 5 and 7 feet from the ceiling of the digester. The Contractor should be aware that the ceiling slopes upward toward the center and the floor slopes downward toward the center.

4.5.5 Power Washing

- Contractor is to power wash the underside the digester ceiling in the areas under the scaffolding. The purpose of the power washing is to remove dried sludge to allow proper inspection of the concrete ceiling.

4.5.6 Lighting

- Contractor is to provide sufficient lighting along the scaffolding to illuminate the walking surface.

4.5.7 Pumping

- Contractor is to provide temporary pumping equipment throughout the inspection period to remove any water that leaks into the digester through pipes or enters the digester as precipitation or groundwater.
- The wastewater from the pressure washing of the ceiling may be disposed into the plant sewer. It does not need to be dewatered. Other water that leaks into the digester after the cleaning process may be disposed into the plant sewer. It does not need to be dewatered.

4 Specific Requirements for Each Bid Item

4.5.8 Inspection Period

- Contractor is to provide the equipment for the Engineer, the Authority, or their representatives for an inspection period of two (2) weeks.

4 Specific Requirements for Each Bid Item

4.6 Bid Item 6

	Item Description
Bid Item 6	Replacement of seven (7) <u>Sludge Valves</u> in the Digester 1&2 Building at the Southside Wastewater Treatment Plant. This work can only be done while Digester 1 is empty.

4.6.1 Background Information

- The existing valves have multiple issues. Some are extremely old and broken, while others are impractical to operate in a safer manner. The fluid that passes through the valves is gritty sludge with rags which is a particularly challenging media for any valve.
- From experience, plant staff has observed that the proposed eccentric plug valves work well for this application if they are installed as requested. In horizontal pipelines, the valves should be installed so the plug shaft is horizontal, and the plug rotates upward as the valve is opened. This prevents grit from settling in the journal and provides a self-cleaning action on the seat.

4 Specific Requirements for Each Bid Item

4.6.2 Proposed Equipment

Approved equipment and materials are listed below. Contractor will coordinate with the Engineer for approval of other makes, models, or materials.

Equipment	Eccentric Plug Valve	
Make	DeZurik	
-	-	↓ Manufacturer's Code
Style	-	PEC
Valve Size	6 inch	6
End Connection	Flanged, ANSI Class 125/150	F1
Body Material	Cast Iron with nickel seat	CI
Packing Material	Acrylonitrile-Butadiene	NBR
Plug Facing	Chloroprene	CR
Actuator Type	G-Series Manual Actuator	GS-6
Actuator Input	See table below	-
Wheel Size	12 inch diameter	12
Actuator Mounting Position	See table below	-
Quantity	Seven (7)	

Valve Location	Pipeline Orientation	Valve Height	Actuator Input	Actuator Mounting Position
Lower Northeast Sewer Pipe from Digester 1 to sewer (out east wall)	Horizontal	Low	Handwheel	standard
Recirculation Suction Pipe from Digester 1	Horizontal	Low	Handwheel	standard
Recirculation Discharge Pipe to Digester 1 (lower valve)	Horizontal	Low	Handwheel	270°
Recirculation Discharge Pipe to Digester 1 (middle valve)	Horizontal	Low	Handwheel	270°
Recirculation Discharge Pipe to Digester 1 (upper valve)	Horizontal	Low	Handwheel	270°
Transfer Suction Pipe from Digester 1	Horizontal	Low	Handwheel	standard
Transfer Gravity Pipe from Digester 1	Horizontal	High	Chainwheel	270°

4.6.3 Removal of Existing Equipment

- Contractor is to remove and dispose the existing valves, bolts, nuts, and gaskets.
- Coordinate removal of these valves when the digester is empty.
- When the valves are removed, flush the sludge pipes into the digester in accordance with Bid Item 1 of this contract.

4 Specific Requirements for Each Bid Item

4.6.4 Contractor's Responsibility

- Refer to Section 3.1 of the *Common Requirements for All Bid Items* for Contractor's Responsibility.
- Contractor will provide all necessary components using the make, models, and materials specified above.

4.6.5 General

- Drawings 6-1 and 6-2 show photographs of the existing valves that are to be replaced.

In <u>horizontal</u> pipelines...	... install the valve so that the <u>plug shaft is horizontal</u> , and the <u>plug rotates upward</u> as the valve is opened.
In <u>vertical</u> pipelines...	... install the valve with the " <u>SEAT</u> " at the <u>top</u> of the valve.

- Contractor is to provide new bolts, nuts, and gaskets.
- Contractor is to paint the new valves in accordance with Section 3.8.8 and 3.8.9 of the *Common Requirements for All Bid Items*.

4.6.6 Identification Tags

- Contractor will provide identification tags as specified in Section 3.10 of the *Common Requirement for All Bid Items*.

4 Specific Requirements for Each Bid Item

4.7 Bid Item 7

	Item Description
Bid Item 7	Installation of one (1) <u>Foam Detecting Radar</u> on Digester 1. This includes electrical work and SCADA programing. This work can only be done while Digester 1 is empty.

4.7.1 Background Information

- Digester foam is a natural phenomenon of anaerobic digestion. It consists of very small gas bubbles trapped in a semi-liquid matrix of sludge. The low-density foam floats near the surface of the liquid sludge. At times, some foam can float many feet above the liquid level.
- Foam that is 1 to 2 feet above the liquid level may be considered a normal level and the digesters are designed to allow for this acceptable level. Foam that is 3 feet, or more, above the liquid level is excessive.
- In the past, the Southside WWTP has experienced numerous instances of excessive digester foaming which resulted in structural damage, spillage, and fouling of the gas-handling system. Until recently, there was no way for the plant staff to measure the height of the foam.
- As part of project WPC 21-4, a radar was installed on Digester 3 with the goal of detecting and measuring the form. The radar has been thoroughly tested in operation and has proven to be effective in measuring the height of the foam. The electromagnetic energy from the radar penetrates through digester gas but reflects off the foam surface. In addition to foam, the radar is capable of detecting and measuring other various sludge surfaces including frothy scum, crusty scum, and floating trash.
- The intent of this bid item is to install a similar radar, in a similar fashion, on Digester 1.

4 Specific Requirements for Each Bid Item

4.7.2 Proposed Equipment

Approved equipment and materials are listed below. Contractor will coordinate with the Engineer for approval of other makes, models, or materials.

Equipment	Foam Detecting Radar	
Purpose	Measure the distance from radar to the top of the foam.	
Make	Endress + Hauser	↓ Ordering Code
Model	Micropilot, 80 GHz, non-contact radar	FMR62
Approval	Class 1, Division 1, Gas groups A-D	FA
Power Supply; Output	2-wire; 4-20mA HART	A
Display, Operation	Prepared for display FHX50 + M12 connection	L
Housing	GT20 dual compartment, Aluminum, coated	C
Electrical Connection	Thread NPT ½, IP66/68 NEMA 4X/6P	D
Antenna	PTFE claddd flush mount 80 mm / 3-inch	GN
Seal	PTFE claddd, -40...392°F, including gas-tight feed through	F6
Process Connection	NPS 3-inch, Class 150, PTFE>316/316L flange ASME B16.5	AGK
Accessory	Weather Protection Cover	PB
Quantity	One (1)	

Equipment	Remote Display	
Purpose	Wall mounted display for radar	
Make	Endress + Hauser	↓ Ordering Code
Model	Remote Display	FHX50
Approval	Class 1, Division 1, Gas groups A-D	FB
Display, Operation	4-line, illuminated, touch control + data backup	E
Housing	Single compartment, Aluminum, coated	C
Cable Length	To Be Determined later during the submittal process.	(TBD)
Process Connection	NPS 3-inch, Class 150, PTFE>316/316L flange ASME B16.5	AGK
Quantity	One (1)	

4 Specific Requirements for Each Bid Item

4.7.2 Proposed Equipment (continued)

Equipment	Stainless Steel, Flanged, Full Port, Ball Valve	
Purpose	Isolation valve for radar	
Make	Apollo	
-	-	↓ Manufacturer's Code
Model	87A-200 Series	87A
Valve Size	3 inch	200
Configuration	Standard	01
Flange connection	ASME Class 150	-
Lock Plate	Included	-
Ball	A276-316 Stainless Steel	-
Body	A351-CF8M stainless steel	-
Inside Diameter	3.00 inches	
Quantity	One (1)	

4.7.3 Contractor's Responsibility

- Refer to Section 3.1 of the *Common Requirements for All Bid Items* for Contractor's Responsibility.
- Contractor will provide all necessary components to ensure that the complete system is fully operational.

4.7.4 Corrosion Protection Measures

- The area where the new equipment will be installed is designated as a "Corrosive Area" as defined in Section 3.8.1 of the *Common Requirements for All Bid Items*. In particular, the equipment will be exposed to the following contributors of corrosion:
 - The continuous presence of moisture and condensing humidity on a diurnal cycle.
 - Fugitive emissions of digester gas which contains between 3,000 and 4,000 ppm of hydrogen sulfide (H₂S).
- Contractor is to ensure that all new equipment and materials installed for this bid item complies with the corrosion protection measures described in Section 3.8 of the *Common Requirements for All Bid Items*.
- All new fasteners and hardware are to be stainless steel or other approved material as specified in Section 3.8.2 of the *Common Requirements for All Bid Items*.

4.7.5 Installation of Radar

- Radar is to be installed in accordance with the Manufacturer's Installation Instructions and as shown on Drawings 7-1, 7-2, and 7-3.
- Contractor is to remove the existing cover for access hatch and store it on-site.
- Contractor is to provide a new fabricated stainless steel plate that will serve as both a removable cover for the access hatch and a mounting location for the radar.
- Contractor is to fabricate custom mounting plate for radar as shown on Drawings 7-2 and 7-3.
- Contractor is to provide equipment calibration and commissioning service as described in the Operating Instructions.

4 Specific Requirements for Each Bid Item

4.7.6 Installation of Remote Display

- Remote Display is to be installed in accordance with the Manufacturer's Installation Instructions.
- Mount the remote display on the inside north wall of the Penthouse of Digester 1&2. Coordinate with the Engineer for the exact location.
- Mount the remote display for about 5'-6" above the floor.
- This display will be for Digester 1 (to the north of the penthouse) and will be mounted on the north wall of the penthouse. There may be a future display for Digester 2 (to the south of the penthouse) and will be mounted on the south wall of the penthouse.

4.7.7 SCADA Programming

- Contractor will ensure that the proposed radar and remote display integrate correctly with the plant's existing SCADA (Supervisory Control And Data Acquisition) system.
- Contractor will provide SCADA programming changes so that information from the radar can be viewed from the SCADA display screen as shown on Drawing 7-4.

4.7.8 Electrical

- Electrical work is to be installed in accordance with NFPA 70, National Electrical Code.
- The area where the new equipment will be installed is considered a "wet location". The Contractor is to provide a Complete Electrical System that is protected to "watertight" level.
- Contractor is to comply with Section 3.8.10 of the *Common Requirements for All Bid Item* regarding corrosion protection of electrical equipment.
- All new fasteners and hardware for electrical components are to be stainless steel or other approved material.
- Contractor will provide new Rigid Aluminum Conduit (RAC).
- Contractor will provide new Liquidtight Flexible Metal Conduit (LFMC).

4.7.9 Identification Tags

- Contractor will provide an identification tag as specified in Section 3.10 of the *Common Requirement for All Bid Items*.

4 Specific Requirements for Each Bid Item

4.8 Bid Item 8

	Item Description
Bid Item 8	Installation of two (2) <u>Sludge Sampling Stations</u> in the Digester 1&2 Building at the Southside Wastewater Treatment Plant.

4.8.1 Background Information

- Sludge is sampled from Digesters 1&2 every day as part of normal plant operations. The current system is sloppy and results in clogged sample ports, clogged floor drains, and poor quality samples that may not accurately represent the composition of the digester.
- The proposed sludge sampling stations will provide equipment that will assist the plant staff in collecting good quality samples which better represent the composition of each digester.

4.8.2 Summary of Proposed Work

The Contractor will complete the following work:

- Install two (2) sludge sampling stations in the Digester 1&2 Building.
- The east station will allow sampling from the sludge recirculation pumps.
- The west station will allow sampling from the sludge transfer pumps.

4 Specific Requirements for Each Bid Item

4.8.3 Proposed Equipment

Approved equipment and materials are listed below. Contractor will coordinate with the Engineer for approval of other makes, models, or materials.

Equipment	Utility Sink	
Make	Regency Tables and Sinks	
-	-	↓ Manufacturer's Code
Material	16-gauge, stainless steel	600S11818B
Style	One Compartment	
Work Height	33-inches	
Bowl (left to right)	18-inches	
Bowl (front to back)	18-inches	
Bowl Depth	13-inches	
Quantity	Two (2)	

Equipment	Drainboard for Utility Sink	
Make	Regency Tables and Sinks	
-	-	↓ Manufacturer's Code
Material	18-gauge, stainless steel	600DTD18183
Dimensions (left to right)	18-inches	
Dimensions (front to back)	18-inches	
Quantity	Two (2)	

Equipment	Flanged Feet for Utility Sink	
Make	Regency Tables and Sinks	
-	-	↓ Manufacturer's Code
Style	Adjustable flanged foot allows anchoring sink to the floor	600SSFF
Quantity	Eight (8), (4 per sink)	

Equipment	Stainless Steel Full Port Ball Valve for Sludge	
Make	Apollo Valves	
-	-	↓ Manufacturer's Code
Material & Style	Stainless Steel, Full Port	76F
Type	NPT Female Connection	1
Variations	Standard	0
Size	1.5 inch	7
Options	Standard	01A
Quantity	Seven (7)	

4 Specific Requirements for Each Bid Item

4.8.4 Drawings

- Drawing 8-1 shows the proposed sink location within the basement of the Digester 1&2 Building.
- Drawing 8-2 shows details regarding the sink drains and floor drains.
- Drawing 8-3 shows piping details for the east sink.
- Drawing 8-4 shows piping details for the west sink.

4.8.5 Documents for Review

Before starting Work on this Bid Item, Contractor will provide Documents for Review in accordance with Section 3.4 of the *Common Requirement for All Bid Items*. For this Bid Item, the following Documents for Review are required:

- Equipment and Material Datasheets with information such as:
 - Make and model.
 - Size and dimensions.
 - Materials of construction.

4.8.6 Contractor's Responsibility

- Refer to Section 3.1 of the *Common Requirements for All Bid Items* for Contractor's Responsibility.

4.8.7 Coordination with Plant Operations

- Work on this bid item includes "Significant Events" and requires coordination with plant operations.
- Contractor will coordinate with the Engineer or Superintendent at least two (2) days before conducting any of the Significant Events as defined in Section 3.2 of the *Common Requirements for All Bid Items*.

4.8.8 Removal of Existing Equipment

The following items are to be removed and disposed:

- Not applicable.

4.8.9 Materials that May be Reused

For this Bid Item, the following existing materials may be reused:

- Not applicable.

4 Specific Requirements for Each Bid Item

4.8.10 Installation of Proposed Equipment

- Install the two sludge sampling stations in accordance with Drawings 8-1, 8-2, 8-3, and 8-4.
- The 6-inch Tee fitting at each Sludge Recirculation Pump (SRP1, SRP2, SRP3) is to be AWWA C153.
- Provide fittings, as needed, to transition from 6-inch flange to 1.5 inch pipe.
- The 1.5-inch sludge piping is to be: Carbon Steel, Schedule 40.
- Route sludge piping from each Sludge Recirculation Pump (SRP1, SRP2, SRP3) at least 7 feet over head (or as high as reasonable). Provide proper bracing for piping.
- For the east sampling station, provide a 1.5-inch valve near each pump and an additional 1.5-inch valve above the sink.
- For the west sink, provide a 1.5-inch valve.

4.8.11 Corrosion Protection Measures

- The area where the new equipment will be installed is designated as a “Corrosive Area” as defined in Section 3.8.1 of the *Common Requirements for All Bid Items*. In particular, the equipment will be exposed to the following contributors of corrosion:
 - The continuous presence of moisture and condensing humidity on a diurnal cycle.
 - The continuous presence of trace amounts hydrogen sulfide (H₂S).
 - Overflows, flooding, and subsequent wash-down.
- Contractor is to ensure that all new equipment and materials installed for this bid item complies with the corrosion protection measures described in Section 3.8 of the *Common Requirements for All Bid Items*.

4.8.12 Electrical

- Not applicable.

4.8.13 Plumbing

- Plumbing Work related to the non-potable water is to be installed in accordance with the applicable plumbing codes (City of Tulsa Title 56 Plumbing Code; International Plumbing Code).
- Pipe material, fittings, and valves for the non-potable water are to comply with Section 605 of the International Plumbing Code.
- Provide a vacuum breaker for the hose bibb for the non-potable water in accordance with Section 608 of the International Plumbing Code. Note that the non-potable water is potable city tap water, but it is down-stream of the building’s backflow preventer. The building’s backflow preventer protects the water outside the building. The purpose of the hose bibb vacuum breaker is to protect the water inside the building.
- Plumbing Work related sink drains and floor drains do not need to comply with plumbing code because they drain to a sump pit and are not connected to a sewer system.
 - Rodent-proofing strainers are not needed at the sink drains nor floor drains.
 - Liquid-seal traps (P-traps) are not needed at the sink drains nor floor drains.

4 Specific Requirements for Each Bid Item

4.8.14 Painting and Coating

Contractor will paint the following items in accordance with Section 3.8.8 of the *Common Requirements for All Bid Items*.

- All sludge piping that is modified or added including the following:
 - 6-inch Tee fitting at each Sludge Recirculation Pump,
 - Transition fittings from 6-inch flange to 1.5 inch pipe,
 - The 1.5-inch carbon steel pipe.
- Please do not paint the stainless steel valves.
- All non-potable water piping that is modified or added is to be painted blue with orange bands (which is the same as the exiting non-potable water piping).
- Acceptable paints include the following:
 - Tnemec, Series N69, Hi-Build Epoxoline II
 - Sherwin-Williams, Macropoxy 646 Fast Cure Epoxy
- Contractor will match the new paint color to be the same color as the existing equipment or the same as other similar equipment.
- Contractor will follow the paint manufacturer's instructions for paint application and dry film thickness.
- Contractor will follow the paint manufacturer's instructions for surface preparation, but as a minimum will remove all oil, grease, dirt, loose rust, loosely adhering paint, and other foreign matter by hand or power tool cleaning per SSPC-SP2 or SSPC-SP3. Strongly adhering paint or asphalt coatings do not need to be removed. Note: SSPC-SP2 is an abbreviation for the Society of Protective Coatings, Surface Preparation standard #2 for Hand Tool Cleaning. SSPC-SP3 is an abbreviation for Surface Preparation standard #3 for Power Tool Cleaning.

4.8.15 Identification Tags

- Not applicable.

4.8.16 Documents for Record

- Not applicable.

4.8.17 Payment for this Bid Item

The Engineer will withhold the following percentage of the dollar amount of this Bid Item:

Amount to be withheld ↓	For any of these issues ↓
20% for Start-up of Equipment
5% for Final Acceptance of the Work

Contractor should refer to the following sections for more information regarding payment:

- Paragraph GC-29 of the *General Conditions of Contract*
- Section 3.12 of the *Common Requirement for All Bid Items*.

4 Specific Requirements for Each Bid Item

4.9 Bid Item 9

	Item Description
Bid Item 9	Rehabilitation of the <u>Diffused Air System</u> within Aeration Basin 1 at the Southside Wastewater Treatment Plant. This includes replacing the membrane disc diffusers, repairing or replacing any broken components, and commissioning of the complete system.

4.9.1 Background Information

- Aeration Basin 1 utilizes a diffused air system to distribute and release air into the raw sewage within the basin. The system consists of a network of membrane disc diffusers and associated air piping which are anchored to the basin floor. The purpose of the diffused air system is to provide an aerobic environment for microbial degradation of organic matter.
- The existing diffused air system was installed in 2012 as part of project ES 2005-05. Most of the membrane disks are original to that project. The membrane disks are at the end of their useful life and are due for replacement.

4.9.2 Summary of Proposed Work

- The plant staff will:
 - Take the aeration basin out-of-service and open the appropriate mud valves to drain the basin.
- The Contractor will:
 - Washdown the interior surfaces of the basin including the floors, walls, piping and components, and remove any trash or debris within the basin.
 - Coordinate with the Engineer to conduct a pre-work inspection of the diffused air system components within the basin to identify any components that should be repaired or replaced.
 - Provide the Engineer with a cost estimate of any potential repairs.
 - The Engineer may direct the Contractor to complete the repairs and fund this cost from the Extra Work Allowance.
 - Or, the Engineer may direct the plant staff to complete some of the minor repairs.
- The Contractor will:
 - Replace all of the membrane disc diffusers in accordance with the manufacturer's instructions.
 - Flush the air piping with water to remove any dirt or debris from the inside of the air piping.
 - Replace any damaged diffuser retainer rings, as needed.
 - The City of Tulsa will bear the replacement cost of any damaged retainer rings that are identified during the pre-work inspection.
 - The Contractor will bear the replacement cost of retainer rings that are damaged by the Contractor during disassembly or reassembly of the diffuser.
 - Coordinate with the Engineer to conduct a post-work inspection of the membrane disc diffusers and the diffused air system components within the basin.
 - Provide commissioning and start-up service in accordance with the manufacturer's start-up procedure.

4 Specific Requirements for Each Bid Item

4.9.3 Proposed Equipment

Approved equipment and materials are listed below. Contractor will coordinate with the Engineer for approval of other makes, models, or materials.

Equipment	Membrane Disc Diffuser
Make	Aquarius Technologies
Part #	MBD-90001-E
Size	9-inch diameter
Material	EPDM

Equipment	Diffuser Retainer Ring
Make	Aquarius Technologies
Part #	DFR-90000-P
Material	PVC

Equipment	Diffuser Wrench – 9"
Make	Aquarius Technologies
Part #	DIF-RNCH9-S

There are nine (9) aeration zones within Aeration Basin 1. The exact number of diffusers within each zone is not currently known. For estimating purposes, the table below shows the information the City of Tulsa currently has.

Basin Zone	Number of Diffusers per Zone as listed in the Aquarius Drawings	Number of Diffusers per Zone as listed in the Project Record Document
Zone 1	1,254	1,260
Zone 2	1,036	1,036
Zone 3	800	801
Zone 4	690	716
Zone 5	576	576
Zone 6	352	395
Zone 7	352	351
Zone 8	352	352
Zone 9	352	325
Total	5,764	5,812

4 Specific Requirements for Each Bid Item

4.9.4 Drawings

- Drawings 9-1 through 9-22 are provided for reference. The Contractor should be aware that these drawings may not fully reflect changes that were made during or after construction.

4.9.5 Documents for Review

Before starting Work on this Bid Item, Contractor will provide Documents for Review in accordance with Section 3.4 of the *Common Requirement for All Bid Items*. For this Bid Item, the following Documents for Review are required:

- Material Datasheets with information such as:
 - Make and model.
 - Size and dimensions.
 - Materials of construction.

4.9.6 Contractor's Responsibility

- Refer to Section 3.1 of the *Common Requirements for All Bid Items* for Contractor's Responsibility.

4.9.7 Coordination with Plant Operations

- Contractor will coordinate with the Engineer regarding the dates when the basin will be out-of-service. The Contractor should provide at least two (2) weeks of advance notice before the basin is to be taken out-of-service.

4.9.8 Removal of Existing Equipment

The following items are to be removed and disposed:

- All existing membrane disc diffusers are to be removed and disposed.
- Damaged diffuser retainer rings are to be removed and disposed.

4.9.9 Materials that May be Reused

For this Bid Item, the following existing materials may be reused:

- Diffuser retainer rings that are in good condition may be reused.

4.9.10 Installation of Proposed Equipment

- Equipment is to be installed in accordance with the Manufacturer's Installation Instructions.

4.9.11 Identification Tags

- Not applicable.

4 Specific Requirements for Each Bid Item

4.9.12 Documents for Record

Contractor will provide Documents for Record in accordance with Section 3.4 of the *Common Requirement for All Bid Items*. For this Bid Item, the following Documents for Record are required:

- Material Data Sheets
- Start-up report, if applicable.

4.9.13 Equipment Commissioning Service

- Contractor is to provide commissioning and start-up service in accordance with the manufacturer's start-up procedure.

4.9.14 Payment for this Bid Item

The Engineer will withhold the following percentage of the dollar amount of this Bid Item:

Amount to be withheld ↓	For any of these issues ↓
20% for Start-up of Equipment
5% for Final Acceptance of the Work

Contractor should refer to the following sections for more information regarding payment:

- Paragraph GC-29 of the *General Conditions of Contract*
- Section 3.12 of the *Common Requirement for All Bid Items*.

4 Specific Requirements for Each Bid Item

4.10 Bid Item 10

	Item Description
Bid Item 10	Replacement of eight (8) <u>Digester Gas Valves</u> at the Digester Buildings of the Southside Wastewater Treatment Plant. This includes a flanged spool pipe for each valve.

4.10.1 Background Information

- The existing valves are made from materials that corroded quickly when exposed to digester gas. As a result of the internal corrosion, the valves leak-by when they are in the shut position.
- The make, model, and material of the proposed valves have been tested successfully at the plant with digester gas.
- The proposed valves have a shorter lay length than the existing valves, so a flanged spool pipe will need to be fabricated for each valve.
- A blow-down valve is to be added to the bottom of each 10-inch diameter spool pipe to allow liquid removal.

4 Specific Requirements for Each Bid Item

4.10.2 Proposed Equipment

Approved equipment and materials are listed below. Contractor will coordinate with the Engineer for approval of other makes, models, or materials.

Location		One at Each Boiler
Equipment	Butterfly Valve	
Make	DeZurik	
-	-	↓ Manufacturer's Code
Valve Style	High Performance Butterfly Valve	BHP
Valve Size	8-inch	8
End Connection	Class 150 Lugged ASME	L1
Body Material	316 Stainless Steel	S2
Packing Material	PTFE	TC
Disc Material	316 Stainless Steel	S2
Shaft Material	316 Stainless Steel	S2
Bearing Material	PTFE Fabric with 317 Stainless Steel	FT
Seat Material	PTFE / Titanium	TT
Actuator Type	Manual Gear	MG-7
Actuator Input	8-inch Chainwheel	CW8
Actuator Option	Safety Lockout	LK
Actuator Option	Flag Indicator	FL
Chain for Chainwheel	Galvanized	CN103
Quantity	Four (4)	

Equipment	Flanged Spool Pipe
Pipe Diameter	8-inch
Pipe	ASTM A312, Grade TP 304L Stainless Steel, Schedule 10S
Flange	Type 304L Stainless Steel
Attachment of flange	Welded
Length	To be determined by Contractor
Quantity	Four (4)

4 Specific Requirements for Each Bid Item

4.10.2 Proposed Equipment (continued)

Location		Two at North Valve Pit Two at South Valve Pit
Equipment	Butterfly Valve	
Make	DeZurik	
-	-	↓ Manufacturer's Code
Valve Style	High Performance Butterfly Valve	BHP
Valve Size	10-inch	10
End Connection	Class 150 Lugged ASME	L1
Body Material	316 Stainless Steel	S2
Packing Material	PTFE	TC
Disc Material	316 Stainless Steel	S2
Shaft Material	316 Stainless Steel	S2
Bearing Material	PTFE Fabric with 317 Stainless Steel	FT
Seat Material	PTFE / Titanium	TT
Actuator Type	Manual Gear	MG-1012
Actuator Input	8-inch Handwheel	HD8
Actuator Option	Safety Lockout	LK
Actuator Option	Flag Indicator	FL
Quantity	Four (4)	

Equipment	Flanged Spool Pipe with Blow-Down Valve	
Pipe Diameter	10-inch	
Pipe	ASTM A312, Grade TP 304L Stainless Steel, Schedule 10S	
Flange	Type 304L Stainless Steel	
Attachment of flange	Welded	
Length	To be determined by Contractor	
Special Instructions	Butt-weld 1-inch diameter stainless steel nipple for blowdown valve	
Quantity	Four (4)	

Equipment	Stainless Steel Ball Valve	Blow-down Valve for 10-inch spool pipe
Make	Apollo Valves	
-	-	↓ Manufacturer's Code
Material & Style	Stainless Steel	76
Type	NPT Female Connection	1
Variations	Standard	0
Size	1-inch	5
Options	Standard	01A
Quantity	Four (4)	

4 Specific Requirements for Each Bid Item

4.10.3 Documents for Review

Before starting Work on this Bid Item, Contractor will provide Documents for Review in accordance with Section 3.4 of the *Common Requirement for All Bid Items*. For this Bid Item, the following Documents for Review are required:

- Equipment and Material Datasheets with information such as:
 - Make and model.
 - Size and dimensions.
 - Materials of construction.

4.10.4 Contractor's Responsibility

- Refer to Section 3.1 of the *Common Requirements for All Bid Items* for Contractor's Responsibility.
- Contractor will provide all necessary components to ensure that the complete system is fully operational.
- WARNING: Digester gas contains between 60 to 65% methane which is flammable. When mixed with air, it can be explosive.
- WARNING: Digester gas contains between 3,000 and 4,000 ppm of Hydrogen Sulfide. Inhalation of digester gas can cause rapid unconsciousness, immediate collapse within 1 to 2 breaths, stop of breathing, and death within minutes.
- While work is being done, the area must be continuously ventilated to remove or dilute digester gas. Contractor is responsible for providing ventilation equipment.
- While work is being done, the air must be continuously monitored for the presence and concentration of hydrogen sulfide and methane using a multi-gas meter that detects both gases. Contractor is responsible for providing air monitoring equipment.

4.10.5 Coordination with Plant Operations

- Work on this bid item includes "Significant Events" and requires coordination with plant operations.
- Contractor will coordinate with the Engineer or Superintendent at least two (2) days before conducting any of the Significant Events as defined in Section 3.2 of the *Common Requirements for All Bid Items*.
- Work will be done in two separate stages. Only one digester building is to be taken out-of-service at a time. Once the work at one building is complete and gas system is back in service, then work may proceed at the other building.

4.10.6 Removal of Existing Equipment

The following items are to be removed and disposed:

- Existing valves

4.10.7 Materials that May be Reused

- Not applicable.

4 Specific Requirements for Each Bid Item

4.10.8 General

- Drawings 10-1 and 10-2 show photographs of the existing valves that are to be replaced.
- The flange-to-flange distance for the existing valves and the proposed valves are different. The proposed valves are shorter. The Contractor is to provide a flanged spool pipe for each valve to makeup the difference.
- The Contractor is to fabricate each 10-inch diameter spool pipe so that it has a 1-inch blow-down valve. The blow-down valve can be attached by butt-welding a 1-inch diameter stainless steel nipple to the 10-inch diameter spool pipe. When installed the nipple and blow-down valve should be at the lowest position of the spool pipe to allow removal of liquid.
- Contractor is to determine the length of each flanged spool pipe based on his own field measurements.
- Contractor is to provide nuts and bolts made from stainless steel.
- Contractor is to provide flange gaskets made from nitrile rubber, also known as Buna-N or NBR (Nitrile Butadiene Rubber).

4 Specific Requirements for Each Bid Item

4.10.9 Installation of Proposed Equipment

- Valves are to be installed in accordance with the table and notes below.
- If possible, position the valve so that the Flag Indicator is easily visible from a normal avenue of approach.
- If possible, install the butterfly valve with the shaft horizontal to provide a self-cleaning action on the seat.

Building	Valve Location	Valve Size	Actuator Input	Special Instructions regarding Valve Seat	Special Instructions regarding Spool Pipe
Digester 1&2	Boiler 1	8-inch	Chainwheel	Note 1	
Digester 1&2	Boiler 2	8-inch	Chainwheel	Note 1	
Digester 1&2	North Valve Pit to North Flare	10-inch	Handwheel	Note 1	Note 3
Digester 1&2	North Valve Pit to Transfer Pipe	10-inch	Handwheel	Note 2	Note 3
Digester 3&4	Boiler 3	8-inch	Chainwheel	Note 1	
Digester 3&4	Boiler 4	8-inch	Chainwheel	Note 1	
Digester 3&4	South Valve Pit to South Flare	10-inch	Handwheel	Note 1	Note 4
Digester 3&4	South Valve Pit to Transfer Pipe	10-inch	Handwheel	Note 2	Note 4

- Note 1: Install the valve so the seat is on the higher pressure side when the valve is closed.
- Note 2: For the valves on the transfer pipe, the seat location does not matter. Therefore, install the valve with the seat on either side to allow for ease of operation.
- Note 3: For the valves in the north valve pit, install the spool pipe on the north side of the valve to facilitate blow-down when the valve is closed.
- Note 4: For the valves in the south valve pit, install the spool pipe on the south side of the valve to facilitate blow-down when the valve is closed.

4.10.10 Painting and Coating

- Not applicable. The valves and flanged spool pipes are stainless steel.
- Factory paint on the valve actuator is acceptable.

4 Specific Requirements for Each Bid Item

4.10.11 Identification Tags

- Contractor will provide identification tags as specified in Section 3.10 of the *Common Requirement for All Bid Items*.

4.10.12 Documents for Record

Contractor will provide Documents for Record in accordance with Section 3.4 of the *Common Requirement for All Bid Items*. For this Bid Item, the following Documents for Record are required:

- Operation and Maintenance (O&M) Manuals.

4.10.13 Payment for this Bid Item

The Engineer will withhold the following percentage of the dollar amount of this Bid Item:

Amount to be withheld ↓	For any of these issues ↓
20% for Documents for Record
5% for Final Acceptance of the Work ... Equipment Identification Tags

Contractor should refer to the following sections for more information regarding payment:

- Paragraph GC-29 of the *General Conditions of Contract*
- Section 3.12 of the *Common Requirement for All Bid Items*.

4 Specific Requirements for Each Bid Item

4.11 Bid Item 11

	Item Description
Bid Item 11	Extra Work Allowance

- The Extra Work Allowance is for any additional labor, materials, or equipment that is not specified in these technical specifications.
- The Extra Work Allowance will be used only at the discretion of the City of Tulsa as detailed in Paragraph GC-26 of the General Conditions of Contract.
- Any allowance balance remaining at the completion of the contract will remain unbilled to the City of Tulsa on the final Application for Payment submitted by the Contractor.
- The Contractor shall submit to the Engineer a detailed cost estimate as described in Paragraph GC-26 of the General Conditions of Contract. The Contractor will proceed with Work included in the allowance only after receiving a written order from the Engineer authorizing such work. Proceeding with work expected to be covered in the allowance without a written order from the Engineer will be at the Contractor's risk. Contractor may not be paid for unapproved work or materials at the discretion of the Engineer.
- Any additional costs for bonds and insurance shall not be included in any Extra Work Allowance because this cost is already included in the contract.

4 Specific Requirements for Each Bid Item

4.12 Bid Item 12

	Item Description
Bid Item 12	Mobilization Allowance. The Mobilizations Allowance shall <u>not</u> exceed 5% of the sum of Bid Items 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11.

- The Mobilization Allowance is intended to cover the costs of bonds, insurance, permits, submittal preparation and other incidental costs at the beginning of the contract period.
- The Mobilization Allowance is optional. The Contractor may elect to bid any dollar value between zero and the maximum allowed Mobilization Allowance.
- The maximum allowed Mobilization Allowance is 5% of the sum of the other Base Bid items (not including the Mobilization Allowance itself). Add Alternate Items are not part of the Base Bid Items.
- To calculate the maximum allowed Mobilization Allowance, sum the dollar values of Bid Items 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and multiply that sum by 0.05.
- Immediately after receiving the Order-to-Proceed, the Contractor may request full payment of the Mobilization Allowance in accordance with Paragraph GC-29 of the *General Conditions of Contract* and Section 3.12 of the *Common Requirements for All Bid Items*.

4 Specific Requirements for Each Bid Item

4.13 Bid Item 13

	Item Description
Bid Item 13	Replacement of the <u>Guard Shack</u> located at the entrance of the Southside Wastewater Treatment Plant.

4.13.1 Background Information

- The existing guard shack is approaching the end of its useful life and is due for replacement.
- The intent of this bid item is to be turnkey replacement of a similar guard shack in the same location.

4.13.2 Summary of Proposed Work

The Contractor will complete the following work:

- Move-out furniture and appliances out of the existing guard shack. City of Tulsa will provide a temporary storage location for the furniture and appliances.
- Remove and dispose the existing guard shack.
- Install a new guard shack in the same location.
- Prepare the shack for use: reconnect electrical power and data connections; restore the area around the shack; move-in furniture and appliances.

4 Specific Requirements for Each Bid Item

4.13.3 Proposed Equipment

Approved features and materials are listed below. Contractor will coordinate with the Engineer for approval of other features and materials.

Guard Shack Size	Approximately 8 feet by 8 feet on the outside. Slightly larger is also acceptable.
Framework	Aluminum or steel.
Exterior Panels	Aluminum or steel, factory painted or vinyl wrapped.
Wall Insulation	Yes, R-10 or better.
Exterior Color	White, metallic, or other light color to minimize solar heat absorption.
Roof Overhang	3 inches or more.
Roof Insulation	Yes, R-10 or better.
Roof Color	White, metallic, or other light color to minimize solar heat absorption.
Interior Wall and Ceiling Panels	Aluminum, painted steel, or Fiber Reinforced Plastic (FRP).
Interior Wall and Ceiling Color	White, gray, or other light color.
Floor Insulation	Yes, R-10 or better.
Door Style	Half-glass, insulated metal or FRP door, sliding or swing-out.
Door Glass	½ inch thick insulated glass.
Door Width	At least 32-inch wide clearance.
Door Hardware	Door lever with deadbolt for swing-out door.
Door Closer	Yes, for swing-out door.
Window Size	At least 36-inch tall. Windows should be positioned on all sides to provide maximum visibility without any significant blind spots.
Window Glass	½ inch thick insulated glass.
Window Tint	Yes, factory tinted to minimize solar heat absorption.
Fixed Windows	Fixed windows are acceptable on 2 or 3 sides.
Sliding Window	At least one (1) sliding window on the side opposite of the door.
Exterior Lighting	Yes, provide exterior flood lights to illuminate the area in front of the door and the area in front of the sliding window that is on the side opposite of the door. Provide an interior switch near the entrance.
Interior Lighting	Yes, ceiling mounted with an interior switch near the entrance.
Electrical Wall Outlets	Yes, provide at least eight (8) electrical outlets rated for 120 volts and at least 15 amps each. The outlets should be spaced around the walls. For example, a duplex outlet on each wall, or in each corner, is acceptable. A quad outlet on two opposite walls is also acceptable. The outlets are intended for the following: mini-fridge; small microwave; desktop computer; computer monitor #1; computer monitor #2; charging base for radio; charger for cell phone; and spare.
Data Connection	Yes, provide outlet for data (telephone/internet).
Climate Control	Yes, provide either a through-wall unit or a roof-top unit capable of providing both Heat and Air Conditioning. The heating and cooling power should be suitable for the size and insulation of the shack and should be compatible with the existing electrical power that is available.
Anchoring	Yes, guard shack should be equipped so that it can be anchored to the concrete foundation.

4 Specific Requirements for Each Bid Item

4.13.4 General

- Drawings 13-1 and 13-2 are provided for reference and show the location of the existing guard shack.

4.13.5 Documents for Review

Before starting Work on this Bid Item, Contractor will provide Documents for Review in accordance with Section 3.4 of the *Common Requirement for All Bid Items*. For this Bid Item, the following Documents for Review are required:

- Drawings with information such as:
 - Size and dimensions.
 - Materials of construction.
 - Location of features such as lights, switches, electrical outlets, data connection, HVAC unit, etc.

4.13.6 Contractor's Responsibility

- Refer to Section 3.1 of the *Common Requirements for All Bid Items* for Contractor's Responsibility.
- Contractor will provide all necessary components to ensure that the complete system is fully operational.
- Contractor will move-out furniture and appliances before removing the existing guard shack. City of Tulsa will provide a temporary storage location for the furniture and appliances. Contractor will move-in furniture and appliances when the new guard shack is ready.

4.13.7 Coordination with Plant Operations

- Contractor will coordinate with the Engineer or Superintendent at least two (2) days before starting work to remove the existing guard shack.

4.13.8 Removal of Existing Equipment

The following items are to be removed and disposed:

- existing guard shack.

4.13.9 Materials that May be Reused

For this Bid Item, the following existing materials may be reused:

- The existing concrete foundation may be reused if it is the acceptable size. If the existing concrete foundation is not the proper size, then Contractor will either provide a new concrete foundation or provide proper extension to the concrete foundation. See Section 4.13.10 below.
- The existing concrete walk path may be reused if it is suitable for the replacement guard shack.

4 Specific Requirements for Each Bid Item

4.13.10 Installation of Proposed Equipment

- Contractor is to provide a proper foundation for guard shack in accordance with the manufacturer's installation instructions. See Section 4.13.9 above.
- Guard shack is to be installed in accordance with the Manufacturer's Installation Instructions.
- Position the proposed guard shack similar to the existing guard shack in the following manner:
 - Entrance door should be on the eastside.
 - If a swinging door is selected, then it should swing out and open to the south.
 - If a sliding door is selected, then it should slide open to the south.
 - At least one (1) sliding window should be on the westside.
 - If a through-wall HVAC unit is selected, then it should be through the south wall.
- Reconnect electrical power and data (phone/internet) connections, as appropriate.
- Restore the area around the shack by laying sod or walk path, as appropriate.
- Provide step(s) to the entrance, as appropriate.

4.13.11 Earthquake and/or Tornado Damage Prevention

Contractor will provide the following items to help prevent damage that might occur during a minor earthquake or tornado:

- Anchor the guard shack directly to the concrete foundation.

4.13.12 Electrical

- Electrical power available at the existing shack is 220 volt, single phase, 60 amps. The Contractor is to ensure the equipment supplied will work with the existing electrical power that is available.
- Electrical work is to be installed in accordance with NFPA 70, National Electrical Code.
- If needed, contractor will provide new Rigid Aluminum Conduit (RAC).

4.13.13 Mechanical

- Mechanical work is to be installed in accordance with International Mechanical Code.

4.13.14 Data (telephone/internet)

- Contractor is to provide data connections so that the telephone and internet within the guard shack works correctly.

4.13.15 Plumbing

- Not applicable.

4.13.16 Painting and Coating

- Factory paint is acceptable.

4.13.17 Identification Tags

- Not applicable.

4.13.18 Documents for Record

Contractor will provide Documents for Record in accordance with Section 3.4 of the *Common Requirement for All Bid Items*.

4 Specific Requirements for Each Bid Item

4.13.19 Payment for this Bid Item

The Engineer will withhold the following percentage of the dollar amount of this Bid Item:

Amount to be withheld ↓	For any of these issues ↓
20% for Documents for Record
5% for Final Acceptance of the Work

Contractor should refer to the following sections for more information regarding payment:

- Paragraph GC-29 of the *General Conditions of Contract*
- Section 3.12 of the *Common Requirement for All Bid Items*.